MERRIMACK RIVER BASIN
EPSOM, NEW HAMPSHIRE

NORTHWOOD LAKE DAM
NH 00285

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS, 02154

OCTOBER 1978

UNCLASSIFIED
ITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
PORT NUMBER : 00285	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
TLE (and Subtitle) rthwood Lake Dam IONAL PROGRAM FOR INSPECTION OF NON-FEDERAL S		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT 6. PERFORMING ORG. REPORT NUMBER
THOR(s) . ARMY CORPS OF ENGINEERS ENGLAND DIVISION		8. CONTRACT OR GRANT NUMBER(s)
RFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
ONTROLLING OFFICE NAME AND ADDRESS T. OF THE ARMY, CORPS OF ENGINEERS ENGLAND DIVISION, NEDED TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE October 1978 13. NUMBER OF PAGES 70
ONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

ISTRIBUTION STATEMENT (of this Report)

ROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

ISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

UPPLEMENTARY NOTES

er program reads: Phase I Inspection Report, National Dam Inspection Program; lever, the official title of the program is: National Program for Inspection of -Federal Dams; use cover date for date of report.

EY WORDS (Continue on reverse side if necessary and identify by block number)

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errimack River Basin
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ittle Suncook River

BSTRACT (Continue on reverse side if necessary and identify by block number)

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:
NEDED

OCT 12 1979

Honorable Hugh J. Gallen
Governor of the State of New Hampshire
State House
Concord, New Hampshire 03301

Dear Governor Gallen:

Inclosed is a copy of the Northwood Lake Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Water Resources Board, the cooperating agency for the State of New Hampshire.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Water Resources Board for your cooperation in carrying out this program.

Sincerely,

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

NORTHWOOD LAKE DAM
NH 00285

MERRIMACK RIVER BASIN
EPSOM, NEW HAMPSHIRE

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

Name of Dam:	Northwood Lake Dam, I.D. NH 00285
State Located:	New Hampshire
County Located:	Merrimack
Town Located:	Epsom
Stream:	Little Suncook River
Date of Inspection:	June 5, 1978

BRIEF ASSESSMENT

Northwood Lake Dam is a concrete gravity structure approximately 165-foot long and 13-foot high. The spillway is a concrete broad crested overflow weir approximately 110-foot long and 12-foot wide.

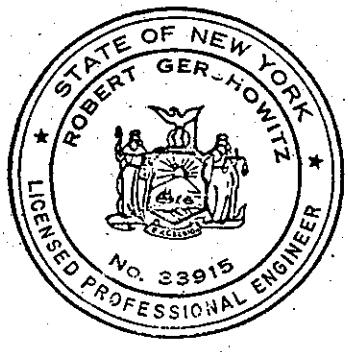
The overall physical condition of the dam is good. The dam has a spillway adequate to pass only 10 percent of the estimated Probable Maximum Flood (PMF), the recommended test flood, before overtopping the concrete non-overflow section of the dam. More detailed hydrologic and hydraulic studies are therefore needed to refine the Spillway Design Flood for this low dam and determine appropriate spillway capacity or the ability of the dam to withstand overtopping.

It is recommended that the owner, within 12 months after receipt of this Phase I Report, acquire basic engineering data in the form of an accurate and complete set of as-built plans, sections and details of the dam and its upstream and downstream reaches that will allow the proper assessment of hydraulic capacity.

Recommended maintenance actions to be completed within 12 months relate to the selective clearing of trees in the area downstream of the spillway and along the banks of the river reach between the dam axis and the roadway bridge downstream of the dam.

The low level outlet hoist is improperly attached to its base and should be reattached. Other recommended repairs to the hoist mechanism are described in Section 7.3.

Robert Gershowitz, P.E.



This Phase I Inspection Report on Northwood Lake Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Charles G. Tiersch

CHARLES G. TIERSCH, Chairman
Chief, Foundation and Materials Branch
Engineering Division

Fred J. Ravens Jr.

FRED J. RAVENS, Jr., Member
Chief, Design Branch
Engineering Division

Saul Cooper

SAUL COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe condition be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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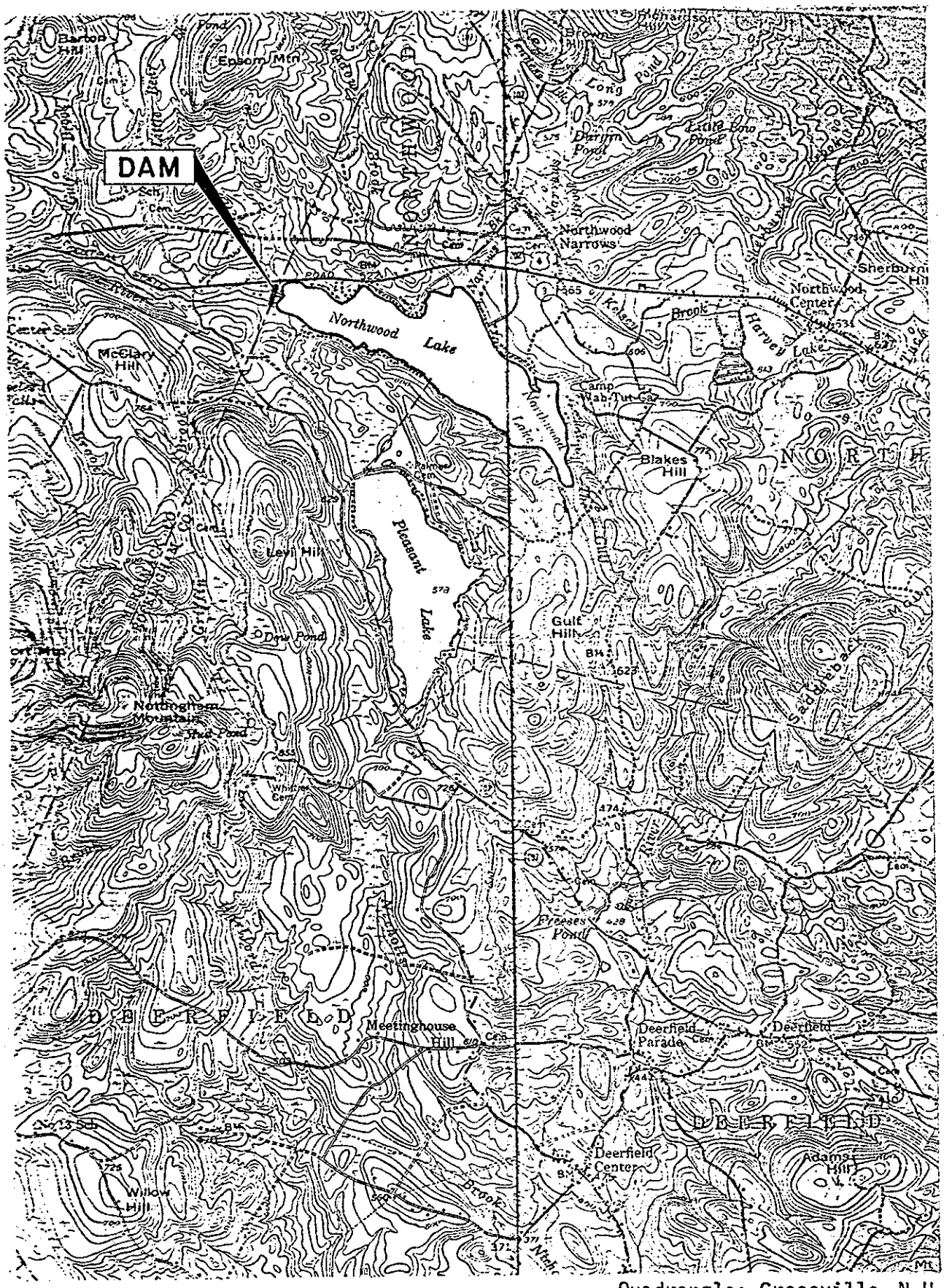
NORTHWOOD LAKE DAM

General view of the dam from downstream looking toward the right abutment. The stop plank section and the low level outlet are in the foreground, the spillway section is in the background.



Quadrangle: Grossville, N.H.
Scale: 1 : 62,500

VICINITY MAP

PHASE I INSPECTION REPORT
NORTHWOOD LAKE DAM NH 00285

SECTION 1

PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. HARRIS-ECI ASSOCIATES has been retained by the New England Division to inspect and report on selected dams in the State of New Hampshire. Authorization and notice to proceed was issued to HARRIS-ECI ASSOCIATES under a letter of June 7, 1978 from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW 33-78-C-0305 has been assigned by the Corps of Engineers for this work.

b. Purpose

(1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-federal interests.

(2) Encourage and assist the States to initiate quickly effective dam safety programs for non-federal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 Project Description

a. Location

Northwood Lake Dam is located on the Little Suncook River in the Town of Epsom, Merrimack County, New Hampshire, approximately 2 miles upstream of the hamlet of Epsom. The Little Suncook River is a tributary to the Suncook River and is part of the Merrimack River drainage basin.

b. Description of Dam and Appurtenances

Northwood Lake Dam is a concrete gravity structure originally built across the Little Suncook River in 1926. The impounded lake is apparently of natural origin and has been raised by the dam. No record plans of the dam exist, and all following dimensions are approximate and subject to verification and possible revision. According to existing records, the dam is approximately 165-foot long, 13-foot high and impounds 2,600 acre-feet derived from a tributary drainage area of 20.7 square miles. The spillway section is constructed of concrete and has a flat crest approximately 12-foot wide. The spillway length is listed variously as 109 and 111 feet but appeared to be shorter on the visual inspection, possibly as a result of a reconstruction completed in 1973.

The area downstream of the spillway section is partly blocked by tree growth. Large stone blocks have been placed downstream of the spillway in order to dissipate the energy of the overflowing water. The low level outlet is located adjacent to the left side of the spillway section and consists of a passage approximately 2.4-foot wide and approximately 4-foot high, controlled by a sluice gate mounted on the upstream face of the dam. The low level sluice gate hoist is housed in a small building on top of a short non-overflow section adjacent to the spillway. A new 12-foot wide stop plank section has been added to the dam in 1973, located to the left of the low level outlet. The entire structure has apparently been founded on ledge rock. Cutoff at the abutments has been

accomplished by means of cutoff core walls running into higher ground on both sides. The left abutment core wall is approximately 32-foot long. The right abutment core wall is about 20-foot long, and was added in 1973. An 8-inch thick concrete facing has been added to the upstream face of the spillover section at an unknown time after the original construction was completed.

Northwood Lake is fairly heavily developed along its rim and some artificial sandy beaches have been located along the shore line. No signs of slope instability could be detected at the visual observation.

The downstream channel of the Little Suncook River is well defined with a rocky bottom. The hamlet of Epsom is the first significant settlement, some 2 miles downstream of the dam axis, with a population estimated at about two hundred persons.

c. Size Classification

According to the "Recommended Guidelines of the Safety Inspection" by U.S. Department of the Army, Office of the Chief of Engineers, the dam is classified in the dam size category as being "Intermediate" since its storage is more than 1,000 acre-feet, but less than 50,000 acre-feet. The dam is also classified as "Small" because it height is less than 40 feet. The overall size classification is determined by the larger of these two classifications, and accordingly Northwood Lake Dam is classified as "Intermediate" in size.

d. Hazard Classification

The dam has been classified as having a High Hazard Potential in the Inventory of Dams compiled by U.S. Army Corps of Engineers on the basis that excessive damage could occur to downstream property in the event of failure of the dam and its appurtenances, together with the possibility of losing more than a few lives. This inspection concurs with the assessment on the basis that the dam impounds considerable volume

of water and that in a case of hypothetical dam failure, the nearest populated settlement at Epsom would have only approximately 10 minutes to implement flood evacuation procedures.

e. Ownership

Northwood Lake Dam is owned by the New Hampshire Water Resources Board (NJ-WRB) headquartered at Concord, New Hampshire.

f. Operator

The Northwood Lake Dam is operated by the N.H. Water Resources Board, headquartered at Concord, New Hampshire - Telephone: (603) 271-3405.

g. Purpose of Dam

The purpose of the dam is recreation and flood control.

h. Design and Construction History

The dam was built in 1926 for Suncook Mills for conservation purposes. The lake at that time was known as Suncook Pond. In 1957, the ownership passed to the N.H. Water Resources Board. No data has been uncovered as to the design and construction history of the dam from available information sources.

i. Normal Operating Procedures

The dam is used to regulate the level of Northwood Lake, by means of uncontrolled flow over the broad crested spillway section, and selective use of the low level outlet and stop plank section. Control of the lake's water surface has been facilitated by the construction of the stop plank section in 1973 which allows a faster regulation and control of the lake surface. The lake level is maintained within one foot of the spillway crest level in the summer months and is drawn down several feet in the winter to accommodate significant snowmelt inflows in the

spring. The lake is considered "flashy" in that the level of the lake rises fairly rapidly in response to ordinary rainfalls over its drainage area. Depending on the season, the lake is visited weekly or semi-weekly by a NH-WRB dam operator to adjust the outflows at the dam in order to achieve targeted lake levels.

1.3 Pertinent Data

a. Drainage Area — 20.7 square miles

b. Discharge at Dam Site

Maximum known flood at dam site:	725 cfs (estimated)
Warm water outlet at pool elevations:	NA
Diversion tunnel low pool outlet at pool elevation:	NA
Diversion tunnel outlet at pool elevation:	NA
Gated spillway capacity at pool elevation:	NA
Gated spillway capacity at maximum pool elevation:	NA
Ungated spillway capacity at maximum pool elevation:	350 cfs (Elev. 519.3)
Total spillway capacity at maximum pool elevation:	350 cfs (Elev. 519.3)

c. Elevation (Feet above MSL)

Top of dam:	519.3
Maximum pool design surcharge:	519.3
Full flood control pool:	NA
Recreation pool:	518.16
Spillway crest:	518.16
Upstream portal invert diversion tunnel:	NA
Downstream at centerline diversion tunnel:	NA
Streambed at centerline of dam:	505 ± (estimated)
Maximum tailwater:	Unknown

d. Reservoir

Length of maximum pool:	3.4 miles (estimated)
Length of recreation pool:	3.0 miles (estimated)
Length of flood control pool:	NA

e. Storage (acre-feet)

Recreation pool:	2,400 (Elev. 518.16)
Flood control pool:	NA
Design surcharge:	3,000 (
Top of dam:	3,000 (Elev. 519.3

f. Reservoir Surface (acres)

Top of dam:	Not available
Maximum pool:	Not available
Flood control pool:	Not available
Recreation pool:	589
Spillway crest:	589

g. Dam

Type:	Concrete gravity
Length:	169 feet
Height:	12 feet
Top width:	12 feet
Side Slopes - Upstream:	Vertical
- Downstream:	Vertical
Zoning:	Not applicable
Impervious core:	Not applicable
Cutoff:	The main part is built on rock with concrete cutoff walls at both abutments
Grout curtain:	None

h. Diversion and Regulating Tunnel

Type:	Not applicable
Length:	NA
Closure:	NA
Access:	NA
Regulating facilities:	NA

i. Spillway

Type:	Broad crested overflow weir
Length of weir:	109.5 (from available records) but seems shorter from visual observations
Crest elevation:	518.16
Gates:	None
U.S. Channel:	Northwood Lake
D/S Channel:	Natural channel of Little Suncook River

j. Regulating Outlets

Low level outlet:	Listed as 3 ft.x 5 ft., estimated at 28 in. x 48 in. during inspection
Controls:	Sluice gate at upstream face of dam
Emergency gates:	None
Outlet:	Downstream channel of Suncook River

k. Stop Plank Section

Passages:	3
Width:	40 in., 38 in., 40 in. net width between retaining beams
Supports:	8 x 8 steel beams, hinged at bottom
Stop planks:	Individual, 7 1/2 in. high
Invert of passage:	Elev. 511.4

SECTION 2

ENGINEERING DATA

2.1 Design

No design data has been recovered for the original dam built in 1926. There are no record or design drawings, hydrologic or stability computations of any kind in the files of the N.H. Water Resources Board (NH-WRB) The dam was modified in 1973 by the NH-WRB by the addition of a 12-foot stop plank section. The plans for this modification consist of marked up drawings of another NH-WRB dam at Silver Lake adapted to Northwood Lake. These modified drawings are shown as Drawings 2 and 3, appended. The marked up drawings bear little or no similarity to the actual structure. A sketch of the actual structure is shown on Drawing 1, made during the visual inspection. No computations relating to hydraulics, hydrology, foundation condition or structural analysis of the 1973 dam modifications were recovered from the NH-WRB files.

2.2 Construction

No data or information has been recovered from any source relating to the construction of the dam except that it was built in 1926.

2.3 Operation

No data on the operation of the dam has been recovered except as given by the NH-WRB dam operator at the time of the visual inspection.

2.4 Evaluation

a. Availability

The available information is virtually non-existant. Although plans for the 1973 stop plank modification are available, they relate only to the details of the modification and not to the general dam setting. There is no set of as-built plans for the dam, and several key dimensions relating to the spillway and low level outlet are not confirmable. No documented data exists on the foundation level or materials overlying the bedrock surface.

b. Adequacy

The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and sound engineering judgment.

c. Validity

The validity of the plans and pertinent data recovered is very questionable. The spillway length is variously given as are the dimensions of the low level outlet. Freeboard dimensions are not consistent. All previously assembled pertinent data cannot be confirmed by the visual inspection. Until as-built drawings are produced, all dimensions are considered questionable, except for the details specifically dimensioned on the stop plank section modification.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General

The general condition of Northwood Lake Dam is good. The dam has been modified and has received maintenance since the time it has been acquired by the N.H. Water Resources Board (NH-WRB).

b. Dam

The dam is a concrete gravity structure founded on ledge rock. The abutment contacts are in the form of cutoff walls extending from the spillover and stop plank sections into higher ground. The right cuttoff wall is of recent construction, dating to 1973. No visible seepage could be discerned, however the spillway was overflowing on the day of inspection and obscured a large part of the downstream face. The original concrete in the spillway section was in fair to good condition, showing moderate signs of freeze-thaw weathering and water caused erosion. No surface cracking or major structural cracking could be detected. No monolith joints were visible but the spillway horizontal lift jointswere visible on the downstream face of the spillway and exhibited minor local erosion and deterioration. The horizontal and vertical alignment of the spillway crest was good to excellent. The top of the broad crested weir was estimated to be level within a 1 inch tolerance over its entire surface. An 8-inch thick facing apparently has been added to the upstream face of spillway section at some time after the original construction. The spillway is ungated and currently no flash boards are used, although apparently in the past they have been. The freeboard between the spillway crest and the top of the dam is extremely limited, amounting to only 13-15 inches. The listed spillway length is 109.5 feet; however, the spillway looked shorter on visual inspection and the dimension should be verified.

Adjacent to, and to the left of the spillway, a short non-overflow section houses the low level outlet gate and its gate house (see Drawing 1). The low level outlet passage has been variously listed as being 3 x 3, or 3 x 5 ft. in size, and is controlled by timber sluice gate on the upstream face of the dam. The size of the low level outlet is estimated at 28 x 48 inches for this inspection report and must be verified by an accurate field survey. The invert elevation of the passage is estimated at 511.4 MSL.

The gate is manually operated by a combination of worm gearing and spur gearing. The gate stem is a 4 in. by 8 in. timber equipped with a cast iron rack spiked to the stem. The stem timber appeared to be in very good condition; however, the rack showed heavy corrosion, and the top two teeth had broken off. The operating mechanism is not securely anchored to the concrete structure of the dam. The existing arrangement employs concrete and timber blocks which hold the operating mechanism approximately one foot above the floor of the gate house. This block arrangement does not have the strength to withstand the horizontal forces developed by the worm gear, and at present the blocks deflect slightly when force is applied to the handwheels.

For this reason, it is recommended that a new hoist pad be poured and properly anchored to the dam structure.

The operating mechanism employs a back up roller which holds the gate stem and rack against the pinion gear and prevents the timber stem from deflecting. Originally this roller was held in place by two cast iron bearing caps bolted to the mechanism frame. Apparently, these iron bearing caps have either broken or become excessively worn, because at the time of this inspection the back up roller shaft was held in place by wooden blocks bolted to the frame. If either of these wooden bearing caps were to fail, the gate would be inoperable until a replacement is fabricated.

In general, because of the many minor deficiencies in the operating mechanism, this gate is considered to lack operational reliability.

Adjacent and to the left of the low level outlet (see Drawing 1) a stop plank section has been installed in a modification made by the NH-WRB in 1973. The stop plank section is 12-foot wide overall with a fixed concrete sill at an elevation estimated to be at 511.4. There are three individual stop plank passes supported by vertical wide flange steel beams and side wall grooves. The individual stop planks are 2 1/2 x 7 1/2 inches in dimension and fit in between the flanges of the steel beams for support. The clear space between flanges of the steel beams is approximately 40-inch wide. Vertical steel beams are required to support the three sets of stop planks. In addition to the recesses in the side walls, the two central steel beams, which have stop logs on both sides, are not rigidly fixed to the dam structure. At the top of each of these two beams, there is a removable pin (1 in. dia. bar stock) securing the beam to the dam structure. In case of emergency, one or both of these pins can be removed, detaching the beam completely and removing with it all stop planks which are in place at the time.

If both center support beams were released, the resulting flow passage would be approximately 11.2-foot wide and almost the full height of the dam. The steel support beams, the retaining pins, and timber stop logs are all in very good condition.

c. Appurtenances

There are no appurtenant structures associated with this dam.

d. Reservoir

The Northwood Lake covers approximately 590 acres at normal pool levels, and is approximately three miles long. The reservoir rim slopes vary from moderately sloping to flat in places. The rim is heavily developed with shore front cottages, and some artificial beach areas have been

created. The general rim slope is heavily wooded and is locally cleared for the summer cottages. There are no signs of slope instability along the lake rim. There is some evidence of sedimentation in the part of the lake immediately behind the dam where it is naturally shallow. It is not known to what extent the channel to the low level outlet and stop plank section is silted in.

e. Downstream Channel

The immediate downstream channel of the Little Suncook River is well defined having a width of approximately 15 feet and rocky or riprapped side slopes of 1 on 4 horizontal. Immediately downstream of the dam, the transition zone area between the 110-foot wide spillway and the 15-foot wide river channel is overgrown with trees, some of which form an island. The stream reach between the dam axis and the nearest downstream road crossing also has trees growing close to the normal channel of river. All of these trees are considered a potential hazard at high spillway or outlet discharges, in that they could be uprooted and plug to the downstream bridge opening, thus creating undesirable high tailwater levels at the dam.

Large stone boulders and riprap have been placed downstream of the spillway and low level outlet to dissipate energy.

3.2 Evaluation

The dam inspection showed that the physical condition of Northwood Lake Dam is generally good, but that improvements could be made as described in Section 7.3.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedures

The reservoir is considered to be " flashy ", in that significant fluctuations in lake levels can be expected at times of moderate rainfall. Depending on the season, the dam is visited on a weekly or semi-weekly basis by an operator of the N.H. Water Resources Board (NH-WRB) for regulation of the lake level to meet targeted lake levels. In the summer time, an attempt is made to maintain the lake level within one foot of the crest elevation by uncontrolled flow over the spillway and stop plank section, or by opening the low level outlet gate or by removing as many stop planks as deemed necessary. In the winter, the NH-WRB practice is to lower the lake level by several feet to prevent ice damage to docking facilities and to provide storage for the heavy spring time inflows due to snowmelt. Spring time low level outlet releases are keyed to the amount of the prevailing snow cover and its water content. Releases are adjusted to achieve the normal full lake elevation by early June.

4.2 Maintenance of the Dam

Maintenance of the dam has been carried out on an as-needed basis based on operations of an experienced state organization. Since the time the dam was acquired by the NH-WRB, the facility appears to have been generally rehabilitated and upgraded.

4.3 Maintenance of Operating Facilities.

The operating facilities are maintained on an as-needed basis in connection with the weekly visits by the dam operator. The low level

outlet hoist mechanism is protected from the elements and casual vandalism within a locked gate house. The stop planks are locked in their grooves against unauthorized removal.

4.4 Description of any Warning System in Effect

As far as can be determined, no warning system is currently in effect to alert downstream residents of impending high stream stages, caused by operating procedures at the dam.

4.5 Evaluation

The operational procedures at the dam are simple, fitting in with the simple facilities involved. In line with greater public interest in dam safety, the owner should institute a bi-annual dam inspection utilizing a simplified version of the visual check list used in this inspection report. The reports should be kept on permanent file. Maintenance schedules should be drawn up and all visits to the dam logged in a permanent record, whether for maintenance or dam operation.

SECTION 5

HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

The evaluation of the hydraulic and hydrologic features of the Northwood Lake Dam was based on criteria set forth in the Corps' Guidelines for Phase I inspections, and additional guidance provided by the New England Division, Corps of Engineers. The Probable Maximum Floor (PMF) was estimated from guide curves from probable maximum flood for New England region, based on past Corps' studies. The PMF peak versus drainage area curves are presented in the section of hydrologic computations.

The PMF curve applicable for flat and coastal areas was adopted for the estimation of PMF peak of the reservoir. The PMF versus drainage relationship can be expressed mathematically as follows:

$$Q = 1{,}020.84 - 304.91 \log_{10} A$$

$$Qp = Q \times A$$

where:

Q = Unit peak discharge in cfs square miles

Qp = Peak PMF discharge, in cfs, for the reservoir

A = Watershed area, in square miles, upstream of the dam axis.

The computed peak discharge of PMF and one half of the PMF for a drainage area of 20.7 square miles using the above equation are 12,826 cfs and 6,413 cfs, respectively. A triangular shaped flood hydrograph was assumed for the inflow design hydrograph.

Both the PMF and one half of PMF inflow hydrographs were routed through the reservoir by the modified Puls Method, utilizing computer program HEC-1. The peak outflow discharges for the PMF and one half of PMF are 10,870 cfs and 5,041 cfs, respectively. Both the PMF and one half of the PMF result in overtopping of the dam.

The reservoir stage-capacity curve was constructed using comparisons of both dam inventory data and planimetered areas, measured from 15-minute quadrangle topography maps. Reservoir storage capacity included surcharge levels exceeding the top of dam assumed that dam remains intact during routing. In the routing computations, the discharge through outlet facilities was excluded due to its insignificant magnitude, as compared to the spillway discharge and the PMF. The spillway rating curve and the reservoir capacity curve are presented in the section of hydrologic computations.

Since the spillway of the dam is incapable of passing the PMF or one half PMF without overtopping the dam, an assessment of downstream hazards due to a flood wave that would result in case of a hypothetical with dam failure was also estimated. The magnitude of the flood wave was estimated using generally accepted "rule of thumb" computational procedures established by the New England Division, Corps of Engineers, in combination with sound hydrologic engineering judgement. Flood routing of the dam break hydrograph for downstream areas are given in the section on hydrologic computations. The result of this computation shows that in the event of a hypothetical dam failure at the time the lake level is at the top of dam, a lake discharge of about 9,250 cfs would be released. Flood stages in the downstream channel reaches are given in the following table.

TABLE 1

Distance Downstream of Dam Axis (Miles)	Est. Flood Stages (Feet)
0.05	9.2
1.0	12.0
2.0 (Epsom)	14.0
3.0 (Gossville)	8.5

The flood stages would affect the structural stability of buildings in the downstream reach whose foundations are below the hypothetical inundation level, and could cause large scale property damage and possible loss of lives.

Since the data used in the determination of downstream flood stages are very preliminary, it is recommended that further hydraulic studies of the downstream channel be carried out in order to accurately assess the downstream hazard to property and life due to a hypothetical dam failure.

b. Experience Data

Records of reservoir stage or spillway discharge are not available for this site. From interview with local residents, it was learned that the reservoir elevation was always below the dam crest even though the spillway is only capable of discharging about 10 percent of the PMF peak.

c. Visual Observations

The spillway structure is in good condition, hydraulically, but the low level outlet was not considered operationally reliable. Sediment deposits were observed in the reservoir adjacent to the upstream face of the right abutment. There were man made beaches along the reservoir rim. Additional sediment deposits into the reservoir from these beaches are likely, but it does not endanger the stability of the dam nor the validity of the reservoir routing.

d. Overtopping Potential

As indicated in Section 5.1.a., both the PMF and one half PMF, when routed through Northwood Lake Reservoir, result in overtopping the dam. The spillway and reservoir surcharge capacities are too small to accommodate the peak flows. The PMF and one half PMF overtopped the dam by 8.25 feet and 4.45 feet respectively (This may or may not affect the stability of the structure). The spillway is only capable of passing a flood equal to 10 percent of the PMF without overtopping the dam. Since the PMF is the Spillway Test Flood for this dam, according to the Recommended Guidelines for Inspection of Dams by the Corps, the spillway capacity of the Northwood Lake Dam is considered inadequate. In determining the spillway capacity at high discharges, the assumption was made that spillway capacity was not affected by submergence caused by high stream stages downstream, This assumption should be verified in subsequent studies.

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

There are no signs of structural instability apparent on visual examination. No leakage or seepage was observed at the abutments or at the toe of the dam where not obscured by overflowing water to the spillway. The dam appeared to be in good alignment and no settlement could be detected. There were no noticeable cracks to indicated overstressed conditions. On the basis of the visual examination and the dam's 50-year service history, structural stability under present conditions is not of great concern because of the dam's low height and relatively substantial width as related to its height.

b. Design and Construction Data

Insufficient documentation has been recovered to assess the structural stability of the dam. No cross sections of the dam are available and the depth to the foundation contact is not defined. No data is available on the properties of the foundation rock on which the dam is apparently founded. There is no pertinent construction data on which an evaluation of structural stability can be founded.

c. Operating Records

No operating records for the dam have been recovered on which an opinion on structural stability can be formulated.

d. Post Construction Changes

After the New Hampshire Water Resources Board took over the ownership of the dam in 1957, the following changes have been made to the dam:

(1) The right abutment core wall was extended 20 feet into the hillside. This modifications is considered beneficial to the overall stability and safety of the dam.

(2) Addition of a 12-foot wide by 6.6-foot high stop-plank section. This modification adds a considerable discharge capacity to the dam and is considered very beneficial in reducing overtopping incidents, which create the risk of potential abutment erosion and undermining.

In addition to the above modifications, the upstream spillway surface has been refaced by the addition of an 8-inch thick concrete wall. This modification is also considered beneficial to the overall stability of the dam.

e. Seismic Stability

The dam is located in Seismic Zone 2 and, in accordance with the Recommended Phase I Guidelines, does not warrant seismic analyses.

SECTION 7

ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition

The overall physical condition of Northwood Lake Dam is good according to the visual inspection performed. The dam's overall safety is in question since the spillway capacity is only 10 percent of the PMF. The spillway discharge capacity has been estimated by current Corps of Engineers' screening criteria, and the owner should determine the spillway capacity by more sophisticated and accurate methods and procedures.

b. Adequacy of Information

The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and sound engineering judgment.

c. Urgency

The urgency of performing the recommendations and remedial measures are detailed below.

d. Need for Additional Investigations

There is no need for further investigations in this phase of the program. Recommended investigations to be carried out by the owner are listed below.

7.2 Recommendations

It is recommended that the owner, within 12 months after receipt of this Phase I Report, assemble the following information.

a. Data Acquisition

(1) An updated as-built set of drawings of the dam showing all pertinent details and correcting inadequacies and omissions on the presently available drawings.

(2) Additional topographic surveys should be made in the reach downstream of the dam axis including details of roadway bridge downstream of the dam.

(3) The area downstream of spillway should be topographically surveyed and all trees larger than 4 inches in diameter should be located and shown on the plans.

(4) Soundings should be made on the upstream side of the dam to determine silt and hard bottom levels.

b. Investigations

Determine and document the spillway capacity of the dam using more sophisticated and accurate methods than were used in the Phase I screening methodology employed in this report, including the routing of the inflow through the lake, and assessment of the effect of possible submergence on the spillway capacity.

Based on the results of the spillway capacity analysis, the owner should formulate plans for augmenting the spillway capacity if shown necessary.

7.3 Remedial Measures

a. Alternatives

The alternatives available for augmenting the spillway capacity of the dam are:

(1) Raising the non-overflow part of the dam to permit greater heads and discharges over and through the existing facilities.

(2) Provision of an additional auxiliary spillway on the left abutment.

(3) Seasonal regulation of the lake levels to provide additional storage capacity in anticipation of large runoff events.

(4) Combination of the above methods.

b. O&M Maintenance and Procedures

The owner should initiate the following programs:

(1) Bi-annual inspection of the dam utilizing a visual check list similar to that used in this inspection report.

(2) Set up a maintenance schedule and log all visits to the dam for operation, repairs and maintenance.

(3) Assemble and keep on hand complete documentation of the dam design, as-built drawings, and any other data pertaining to the dam safety.

(4) Selectively clear trees in area downstream of the main spillway that could be uprooted during high spillway discharges

and cause damage to or plugging of the roadway bridge immediately downstream of dam. Selectively remove trees along the reach of Little Suncook River channel that pose a similar potential risk to the bridge.

(5) Securely fasten the low level outlet gate hoist to the floor of the gate operating house, so that it remains rigid during operation. Repair missing teeth on the gate hoist rack. Replace wooden hoist stem backing roller shaft bearing caps with cast iron ones of suitable design.

(6) Maintain a silt free channel to the low level outlet sluice gate and stop plank section of the dam.

(7) The owner should establish a formal system with local officials for warning downstream residents in case of emergency. Round the clock surveillance should be provided by the owner during periods of unusually heavy precipitation.

APPENDIX A

CHECK LISTS:
- VISUAL OBSERVATIONS
- ENGINEERING, CONSTRUCTION MAINTENANCE DATA
- HYDRAULIC AND HYDROLOGIC DATA ENGINEERING DATA

CHECK LIST
VISUAL INSPECTION
PHASE 1

Name Dam NORTHWOOD LAKE DAM County Merrimack State New Hampshire Coordinators

Date(s) Inspection June 5, 1978 Weather Sunny Temperature 65°F

Pool Elevation at Time of Inspection 518.4 M.S.L. Tailwater at Time of Inspection 509.3 M.S.L.

Inspection Personnel:

Seymour Roth
David Kerkes
Yin Au-Yeung
Lynn Brown
William Flynn

Recorder: Seymour M. Roth

Representing the owner, N.H. Water Resources Board:

Mr. Lyall Milligan, Dam Operator

Note: NA means Not Applicable

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SEEPAGE OR LEAKAGE	None visible	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	Good contact between dam masonry and apparent ledge foundation on both abutments. The left abutment cutoff wall is 20-foot long, and the right abutment cutoff wall is 32-foot long.	
DRAINS	No drains were observed.	
WATER PASSAGES	Stop log slots have been added to the non-overflow section of the dam. Each of the three stop log slots is 4-foot wide and extend 6 ft.-7 in. below spillway crest level. The concrete, steel and wood components are in excellent condition. The intermediate supports are hinged to provide a 11 ft.-2 in. wide by 6.5 ft. high opening in an emergency.	
FOUNDATIONS	Apparently, the structure is founded on a bedrock of gneiss or shist.	

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	No significant cracks can be visually observed.	
STRUCTURAL CRACKING	None observed	
VERTICAL & HORIZONTAL ALIGNMENT	The vertical alignment of the spillover section is good Apparently, there is less than one inch difference in elevation. The horizontal alignment of the structure is good, there are no visible deviations or offsets.	
MONOLITH JOINTS	None observed	
CONSTRUCTION JOINTS	The original concrete of the dam has been placed in 3-foot high lifts. These lift joints are partly eroded on the downstream side of the spillover section.	No action required.

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	Not applicable	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	Not applicable	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Not applicable	
VERTICAL & HORIZONTAL ALIGNMENT OF THE CREST	Not applicable	
RIPRAP FAILURES	Not applicable	

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Not applicable	
ANY NOTICEABLE SEEPAGE	Not applicable	
STAFF GAGE AND RECORDER	Not applicable	
DRAINS	Not applicable	

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CRACKING & SPALLING OF CONCRETE SURFACES IN STILLING BASIN	Not applicable	
INTAKE STRUCTURE	None	
OUTLET STRUCTURE	A low level outlet passage, 28-inch wide by 48-inch high, passes through the dam and is controlled by a sluice gate on the upstream face of the dam. The outlet passage concrete is in fair serviceable condition.	
OUTLET FACILITIES	See "Concrete/Masonry Dam", "Water Passages"	
EMERGENCY GATE	The sluice gate hoist rack is heavily corroded at the top and has two broken teeth. The hoist mechanism is poorly anchored to floor, deflecting when sluice is lifted. The lifting stem backing roller shaft is operating with wood replacement bearing caps instead of the original cast iron ones	Refurbish gate hoist system by bolting hoist to suitable concrete foundation pad. Replace wooden lifting stem backing roller shaft bearing caps with cast iron ones.

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONCRETE WEIR	The concrete spillover section is approximately 80-foot long and 12-foot wide. The crest is completely flat and level. An 8-inch facing wall has been added to the upstream face of the spillover section since the original construction.	
APPROACH CHANNEL	The approach channel is the western end of Northwood Lake which is approximately 1,000-foot wide at the outlet end.	
DISCHARGE CHANNEL	The discharge from the spillover section rejoins the channel of the Little Suncook River. Part of the downstream area is overgrown with substantial tree growth. Heavy stone riprap channel protection has been placed downstream of the spillover section, the stop log section and the low level outlet.	Remove trees from area downstream of the spillover section. Regrade area as required to permit a smooth hydraulic transition to the downstream channel.
BRIDGE AND PIERS	A concrete walkway has been placed over the stop log section to gain access to the low level outlet gate house from the left abutment.	

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONCRETE SILL	Not applicable	
APPROACH CHANNEL	Not applicable	
DISCHARGE CHANNEL	Not applicable	
BRIDGE AND PIERS	Not applicable	
GATES & OPERATION EQUIPMENT	Not applicable	

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
MONUMENTATION/ SURVEYS	Not applicable	
OBSERVATION WELLS	Not applicable	
WEIRS	Not applicable	
PIEZOMETERS	Not applicable	
OTHER	A lake gage on the upstream face of the dam reads zero at the normal pool level Elev. 518.16 MSL.	

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENTATIONS
SLOPES	The reservoir slope is fairly flat, 1 on 5 horizontal up to a point 5 feet above prevailing lake level, where the slope steepens. The reservoir rim is generally wooded except where locally cleared for residential development.	
SEDIMENTATION	Some sedimentation noticeable in the immediate area of the dam, but not enough to affect hydrologic or stability parameters.	Survey lake depth behind dam to ascertain maximum drawdown potential under present conditions.

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The natural channel is unobstructed, but has a narrow foot bridge downstream of the dam axis that could be swept away and block the highway bridge across the river 200 feet downstream of the dam.	See remarks under "Ungated Spillway-Discharge Channel" Selectively remove trees likely to be uprooted under high stream flow conditions in reach between dam and highway.
SLOPES	The channel is well defined with 1 on 4 horizontal riprapped banks in the 200-foot reach downstream of the dam to the highway. The stream bottom is rocky.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	Less than 10 residences are in evidence along the banks of river in immediate downstream area. The nearest population center is Epsom, with a population estimated at several hundred people.	

ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Not available
REGIONAL VICINITY MAP	Available
CONSTRUCTION HISTORY	Not available
TYPICAL SECTIONS OF DAM	Not available
HYDROLOGIC/HYDRAULIC DATA	Not available
OUTLETS - PLAN	Available for rebuilt stop plank section
- DETAILS	
- CONSTRAINTS	Not available
- DISCHARGE RATINGS	
RAINFALL / RESERVOIR RECORDS	

ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
(continued)

ITEM	REMARKS
DESIGN REPORTS	Not available
GEOLOGY REPORTS	Not available
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None available
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None available
POST-CONSTRUCTION SURVEYS OF DAM	Not available
BORROW SOURCES	Not available
SPILLWAY PLAN - SECTIONS - DETAILS	Not available

ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
(continued)

ITEM	REMARKS
OPERATING EQUIPMENT PLANS AND DETAILS	Not available
MONITORING SYSTEMS	Not available
MODIFICATIONS	A 12-foot wide stop plank section has been added by the N.H. Water Resources Board in 1973.
HIGH POOL RECORDS	Pool records are kept by the N.H. Water Resources Board.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None uncovered although stop plank section has been added for good and sufficient reasons.
PRIOR ACCIDENTS OF FAILURE OF DAM - DESCRIPTION - REPORTS	None known
MAINTENANCE OPERATION RECORDS	No formal records available.

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

Name of Dam: NORTHWOOD LAKE DAM

Drainage Area Characteristics: 20.7 square miles

Elevation Top Normal Pool (Storage Capacity): 518.16

Elevation Top Flood Control Pool (Storage Capacity): Not applicable

Elevation Maximum Design Pool: 519.18

Elevation Top Dam: 519.3

SPILLWAY CREST:

a. Elevation 518.16
b. Type Overflow: flat, broad crested weir
c. Width 12 feet approximately
d. Length 109.5 feet
e. Location Spillover Left side of dam
f. No. and Type of Gates None

OUTLET WORK:

a. Type Slide gate 2.4 x 4-foot high
b. Location Adjacent to left side of spillover section
c. Entrance Inverts 508.7 estimated
d. Exit Inverts 508.7 estimated
e. Emergency Draindown Facilities 12 wide stop plank section Inv. 511.4

HYDROMETEOROLOGICAL GAGES:

a. Type Staff gage
b. Location Left wingwall of dam
c. Records None available

MAXIMUM NON-DAMAGING DISCHARGE 750 cfs (estimated)

APPENDIX B

PHOTOGRAPHS

ALL PHOTOGRAPHS TAKEN ON JUNE 5, 1978

Photo 1 - View of the left abutment from downstream. The spillway is on the left of the picture, the low level outlet is in the center with the gate house over it, and the new stop plank section is on the right.

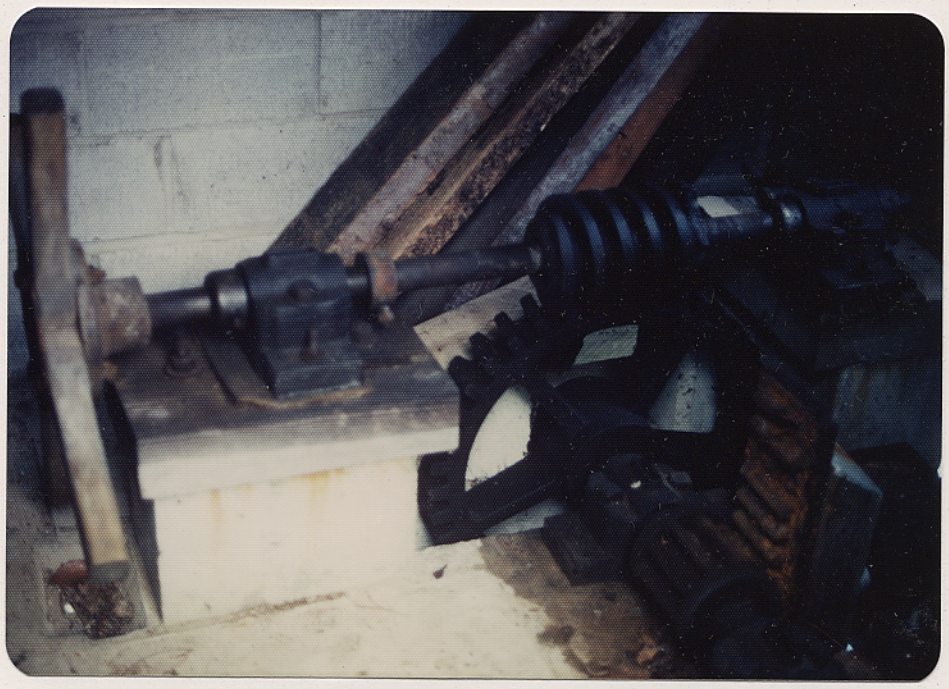


Photo 2 - Interior view of the gate house showing the gate hoist for the low level outlet. The gate hoist is inadequately anchored to the floor.

Photo 3 - View of the dam from the upstream side.

Photo 4 - View of the dam from the roadway crossing downstream of it. Note that the area downstream of the spillway on the left side of the picture is partly blocked by tree growth.

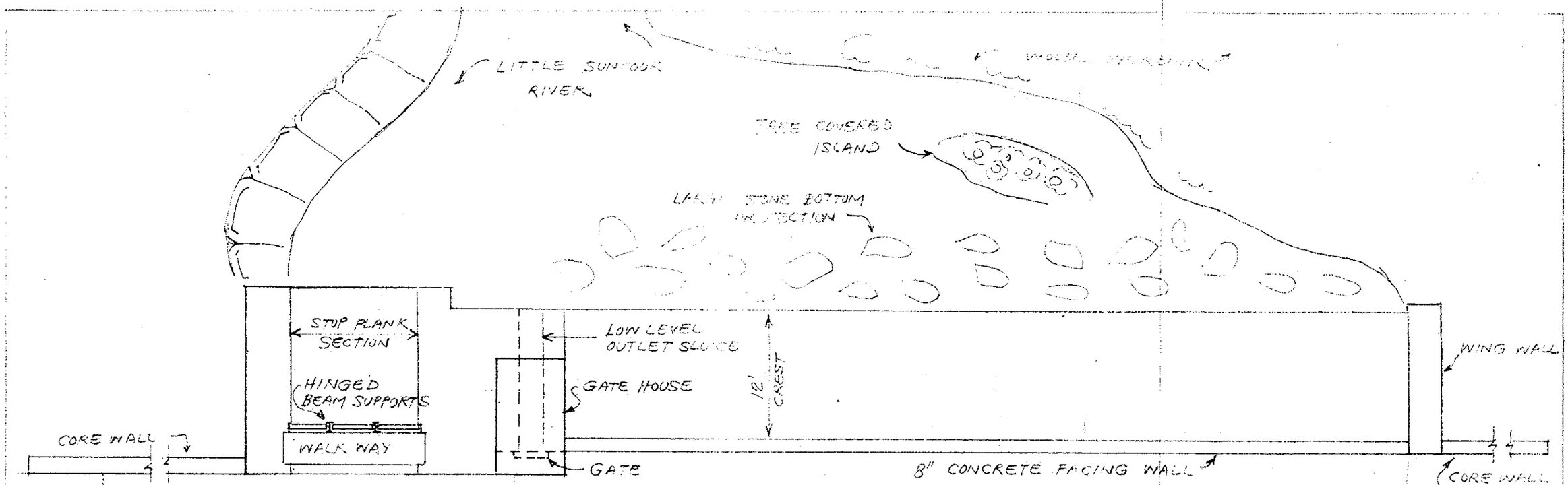
Photo 5 - View of the downstream channel of Little Suncook River taken from the dam.

Photo 6 -View of the rim of Northwood Lake taken from the dam axis.

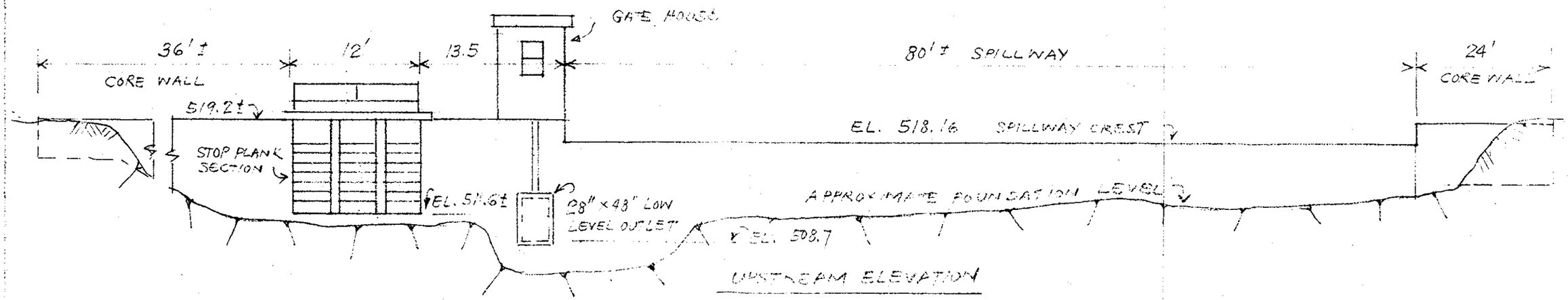
APPENDIX C

PLATES

PLANS & DETAILS OF DAM	Drawings 1, 2 & 3
GEOLOGIC MAP	Drawing 4



PLAN OF DAM



UPSTREAM ELEVATION

HARRIS · ECI ASSOCIATES	
NORTHWOOD LAKE DAM	DWG.
FIELD INSPECTION SKETCH	1

Existing Outlet

Stone riprap Chink with stone & concrete (5 Ft. from bottom slab. Slope to existing streambed elevation.

Existing Structure

3'-0"
1'-0"
1'-3"
12'-0"
1'-3"
30°

1'-3"
12'-0"
1'-3"

* To be determined in field

Existing Gate House

22'-0"*
Section
3'-6"
Sidewalk
Standard 2"ø steel pipe railing
8'-0"
Existing Stone Wall

Top of existing concrete wall

Top of existing concrete wall

Existing channel

Excavate new channel to top of concrete slab.

Rip rap

PLAN
Scale: 1"=4'-0"

General Notes:
Concrete - Air entrained Class A f'_c = 3000 psi
Reinforcing steel - Intermediate Grade f_s = 20,000 psi
Place all reinforcing bars 3" clear of concrete surface unless shown otherwise.
All existing dimensions shown shall be verified in the field.
Repair existing gate mechanism as required.

Gage Reading = 2.10 Ft. May 18, 1972

Existing Gravel Roadway

Existing gate house

Standard 2"ø steel pipe rail

Match existing concrete elevation

Northwood Lake Top of Existing Crest H2O

5'-9½"±

Top Slope = 101.17

Top Crest = 100.00

Weld Staff Gage = 0 (Full Lake)

4.8' Desn

Top Slope = 93.23

Bot. Elevation = Below 72.50

Weld Way Water To Seal Leakage Around Existing Dam

Existing Gate

Concrete cutoff wall

ELEVATION.
Scale: 1"=4'-0"

Notes:
Wingwall footing dimensions and steel requirements to be calculated after final elevations have been established in the field.

93.23
-.25
93.48
-.133
93.15

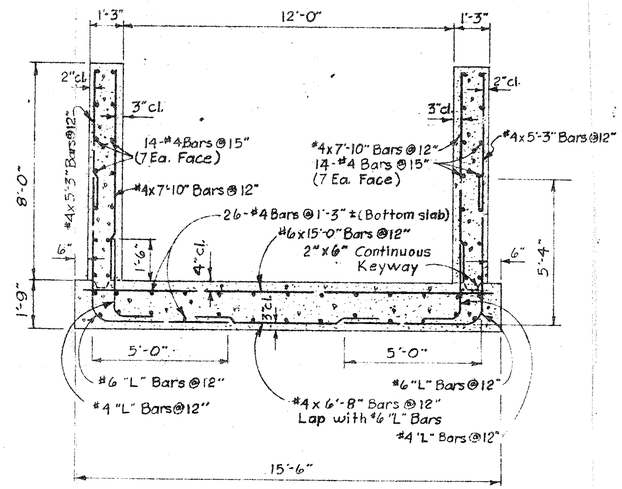
103.92
-73.42
30.5' ± Berm

DWG. NO. 2

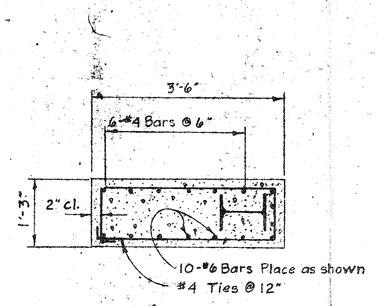
Designed by D.M.R.
Drawn by D.M.R.
Traced by
Checked by

REVISIONS
DATE

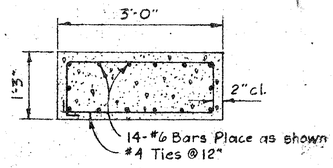
Northwood LAKE DAM
Epsom, NEW HAMPSHIRE
PLAN & ELEVATION
Constructed Jan.-June 1973
NEW HAMPSHIRE WATER RESOURCES BOARD
CONCORD, N.H.
Sheet 2 of 4
JUN 6 1973



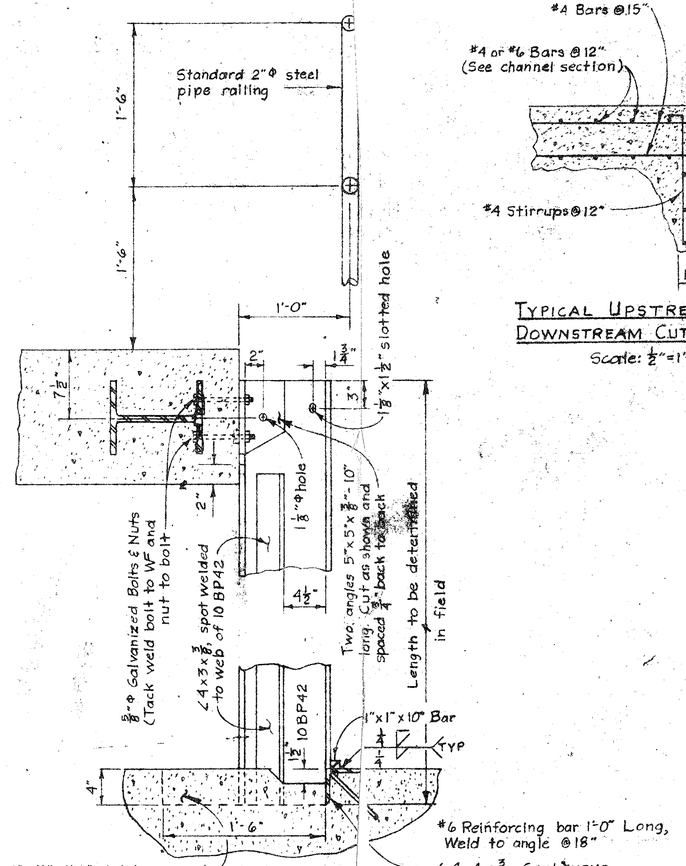
TYPICAL CHANNEL SECTION
Scale: $\frac{3}{8}$"=1'-0"



SIDEWALK SECTION.
Scale: $\frac{3}{4}$"=1'-0"

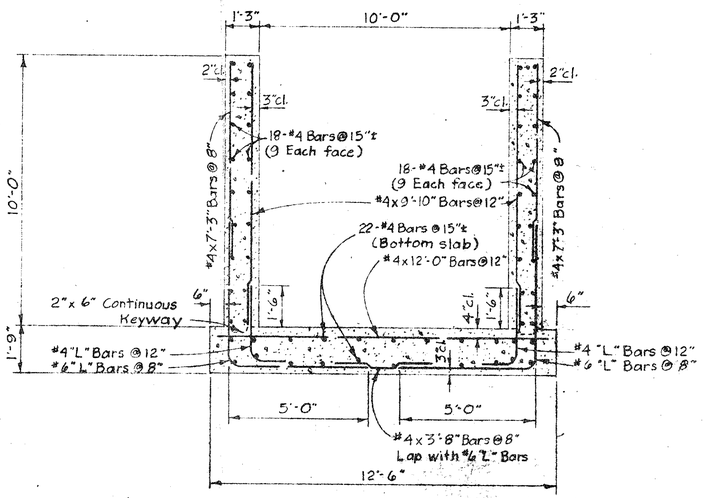


STRUT SECTION
Scale: $\frac{3}{4}$"=1'-0"

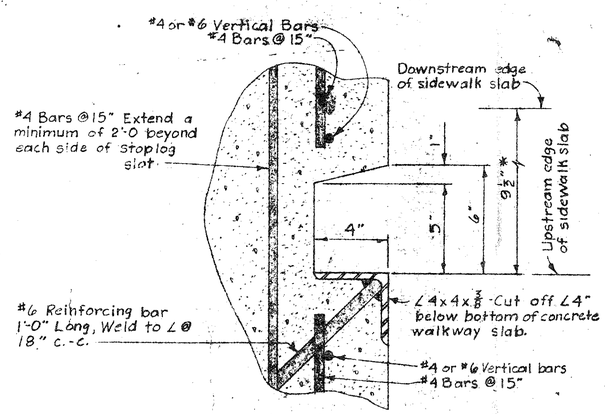


TYPICAL STANCHION BEAM
Scale: 1½"=1'-0"

TYPICAL UPSTREAM AND DOWNSTREAM CUT OFF WALL
Scale: ½"=1'-0"

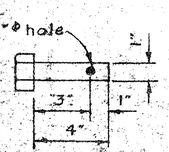


OPTIONAL CHANNEL SECTION
Scale: $\frac{3}{8}$"=1'-0"



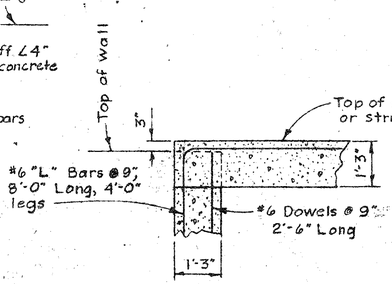
*This dimension is based on a 10BP42. Adjust if other size stanchion beam is used.

TYPICAL STOPLOG SLOT



NOTE:
4ϕ Shaft of pin to be smooth

LOCKING PIN DETAIL
Scale: 3"=1'-0"



NOTE:
Reinforcing Steel in sidewalk or strut not shown.

SECTION AT SIDEWALK OR STRUT
Scale: ½"=1'-0"

DWG. NO. 3

Designed by D.M.R.
Drawn by D.M.R.
Traced by
Checked by Francis C. Moore

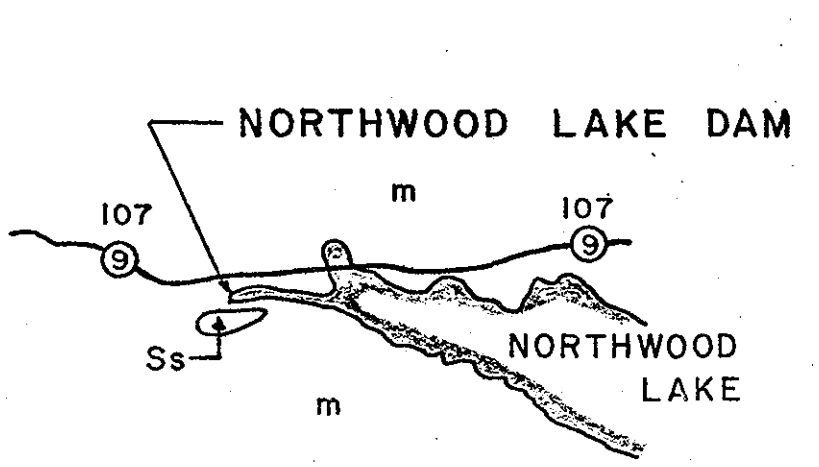
DATE

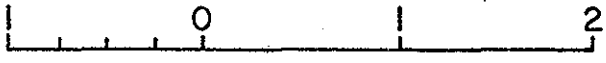
REVISIONS

Northwood [redacted] LAKE DAM
Epsom [redacted], NEW HAMPSHIRE
TYPICAL SECTIONS

NEW HAMPSHIRE WATER RESOURCES BOARD
- CONCORD, N. H. -

Sheet Scale: As noted | Sheet 2 of 2 | JULY 1972





Scale: 1" = 1 Mile

LEGEND:

m	Ground Moraine (Till)
Ss	Stratified Sandy Gravel Deposits with Boulders in Kame and Kame Terraces
———	Contact

NOTE: Mica Schist Comprises Bedrock

GEOLOGIC MAP
NORTHWOOD LAKE DAM

DWG. NO. 4

APPENDIX D

HYDROLOGIC COMPUTATIONS

NH SAFETY INSPECTION
NEW HAMPSHIRE - NORTHWOOD LAKE DAM.
RO/HYDRAULICS / PMF

SHEET NO. ____ OF ____
JOB NO. 1211
BY YIN DATE JUNE 15

Maximum Probable Flood Peak Flow Rate.

According to NED General Curve

Assume FLAT & COASTAL region

$Q = 1020.84 + 304.91 \log_{10} A$

$A = 20.7$ sq. mile.

$\therefore Q = 619.6$ cfs/sq. mile.

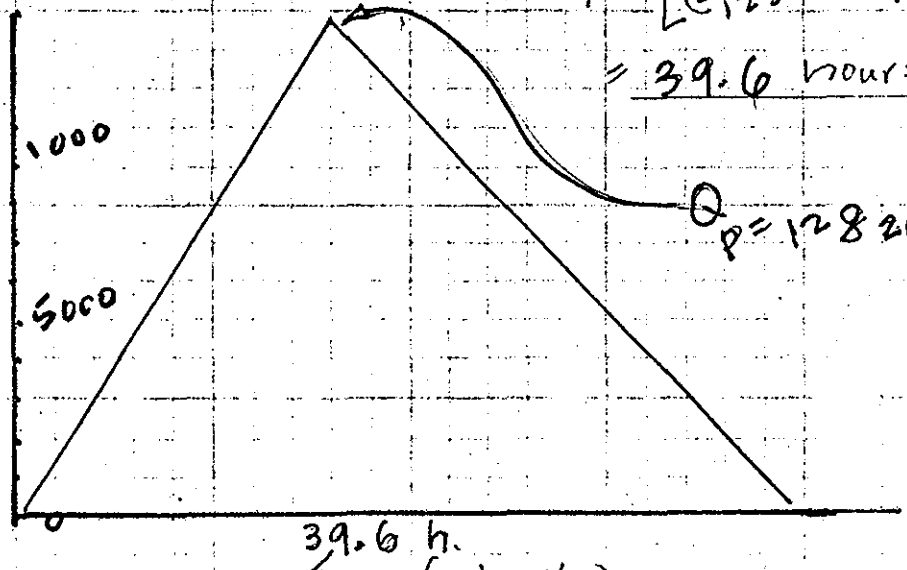
$Q_p = A \times Q = 20.7 \times 619.6 = 12,826$ cfs.

Since MPF runoff in New England equals approx. 19 inches according to NED guideline:

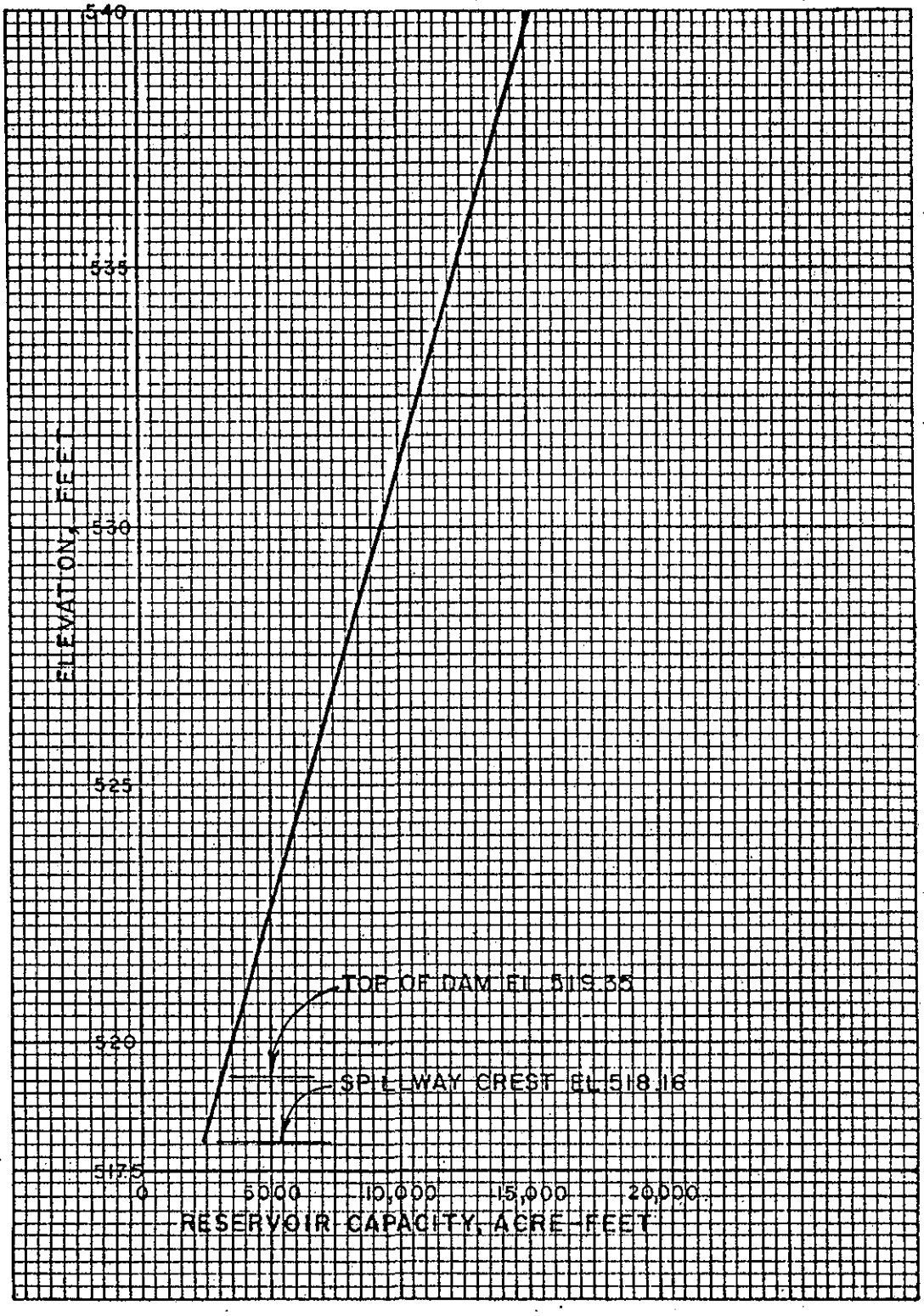
The triangular hydrograph will be approximate to the following shape: $\frac{1}{2} T \times Q_p = 19'' \times A$

$\therefore T = \left[\left(\frac{19}{12}\right) \times 20.7 \times 27,878,400\right] / 3600 \times Q_p$

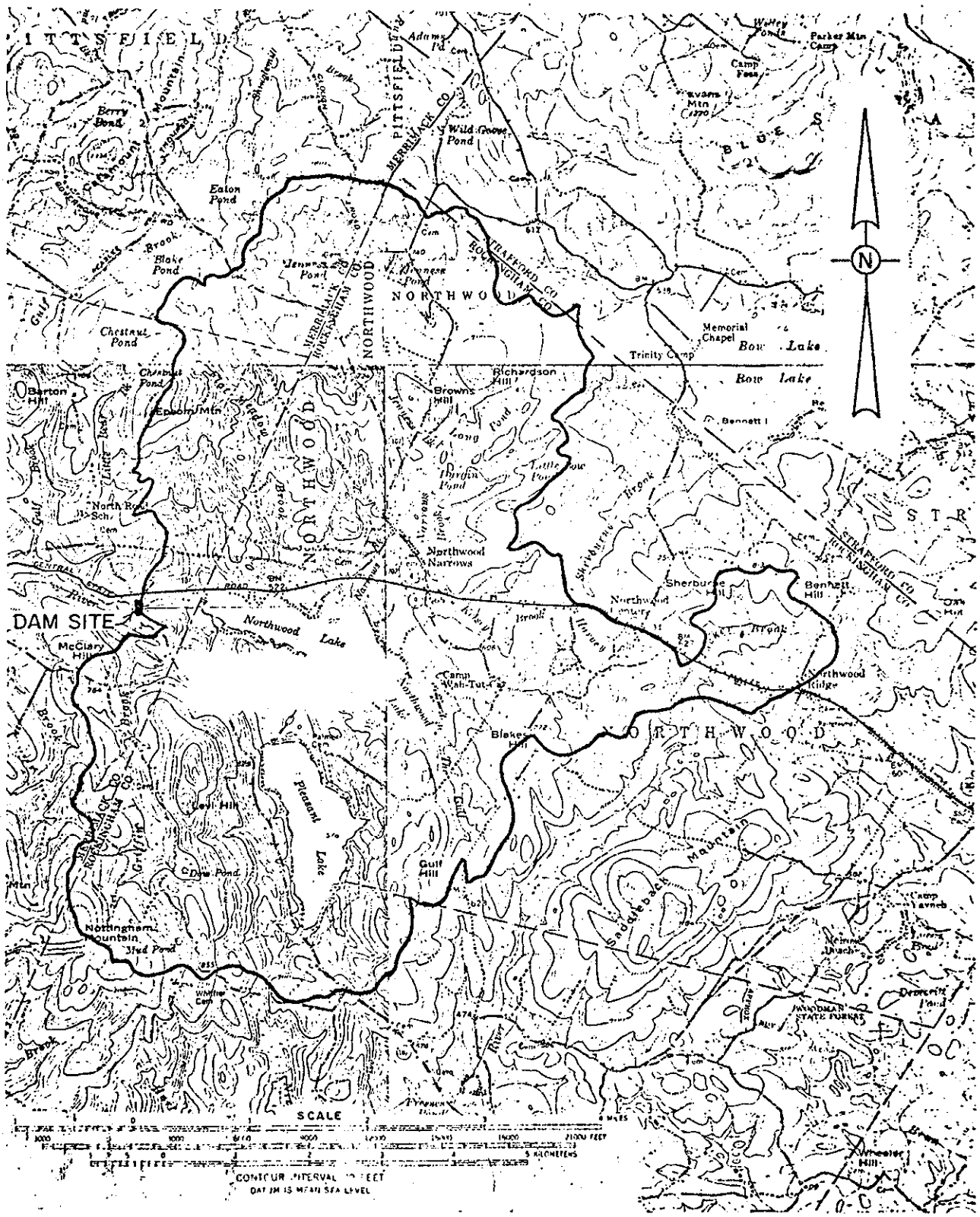
$= 39.6$ hours



NORTHWOOD LAKE DAM
SPILLWAY AND OVERTOP
RATING CURVE



NORTHWOOD LAKE DAM
RESERVOIR CAPACITY CURVE



NORTHWOOD LAKE DAM
DRAINAGE BASIN

NORTHWOOD LAKE DAM

STUDY OF THE EFFECTS OF DAM FAILURE

Step1: Determine Surcharge Height at SPMF:

SPMF = 12,826 cfs

Routed SPMF (HEC-1) = 10,870 cfs

Surcharge Height (above Spillway Crest)

to pass 10,870 cfs = 526.70 - 518.16

= 8.54 ft (from Spillway & Overflop Rating Curve)

Step2: Determine Peak Failure Outflow Q_{P_1}:

$$Q_{P_1} = \frac{8}{27} W_b \sqrt{2g}\, Y_o^{3/2}$$

W_b = 0.40 x Dam length across river at mid height at SPMF

= 0.40 x 169'

= 67.60 ft

Y_o = Total height from river bed to pool level at failure

= Height top of dam to bed of Stream

= 14.3 ft

ENGINEERING CONSULTANTS, INC.

NH HAZARDOUS DAM SAFETY INSPECTION — SHEET NO. 2 OF
HOSTWOOD LAKE DAM — JOB NO. 1211-001
DAM FAILURE STUDY — BY MAS DATE 7-87

$$Q_{p_1} = \frac{8}{27}(67.60)\sqrt{64.4}\,(14.3)^{3/2}$$
$$= 9250 \text{ cfs}$$

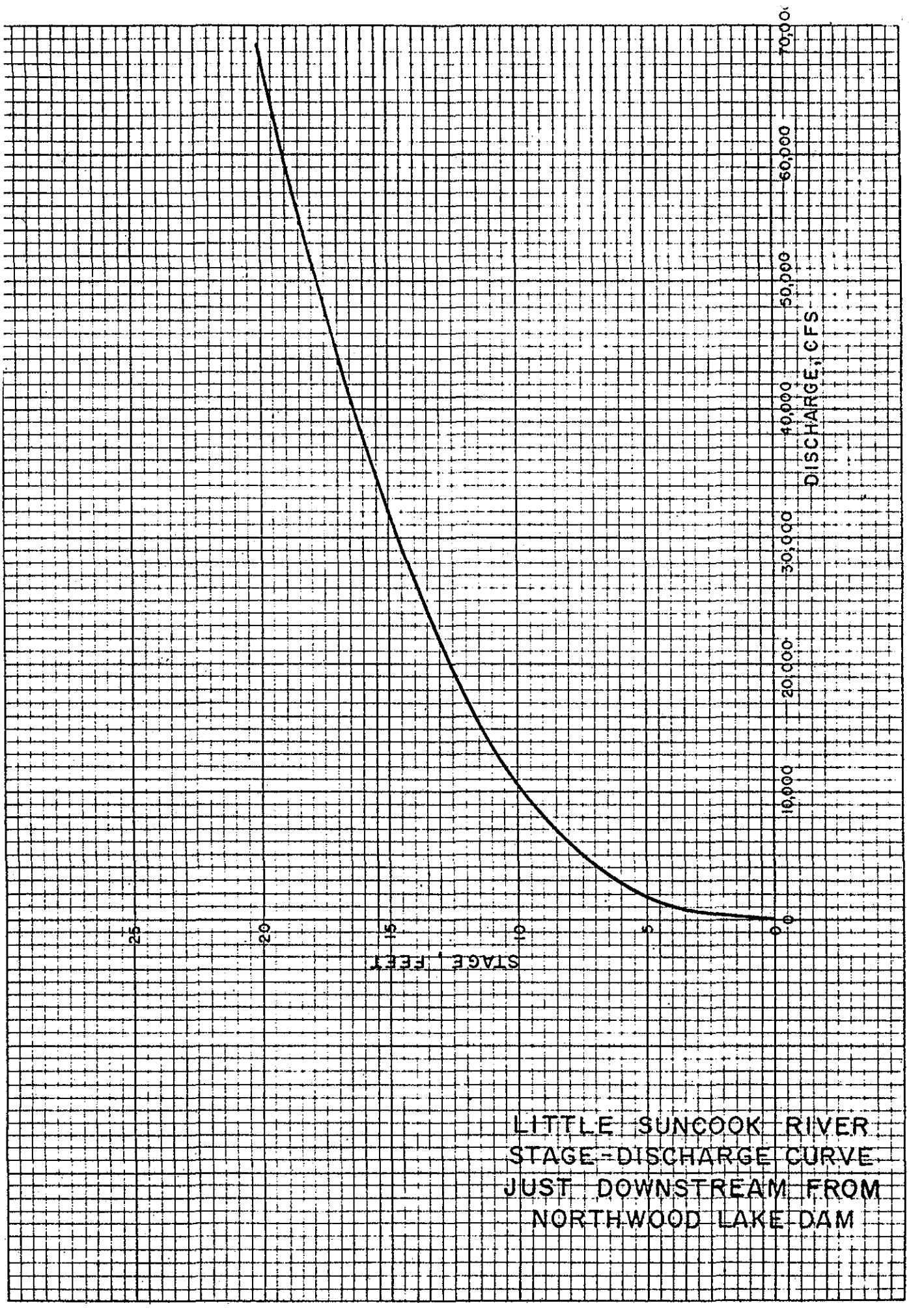
Step3: Develop stage discharge curves for the downstream channel (assumptions and procedure are same as for Stinson Lake Dam).

The stage-discharge curves are on pages 3 through 6.

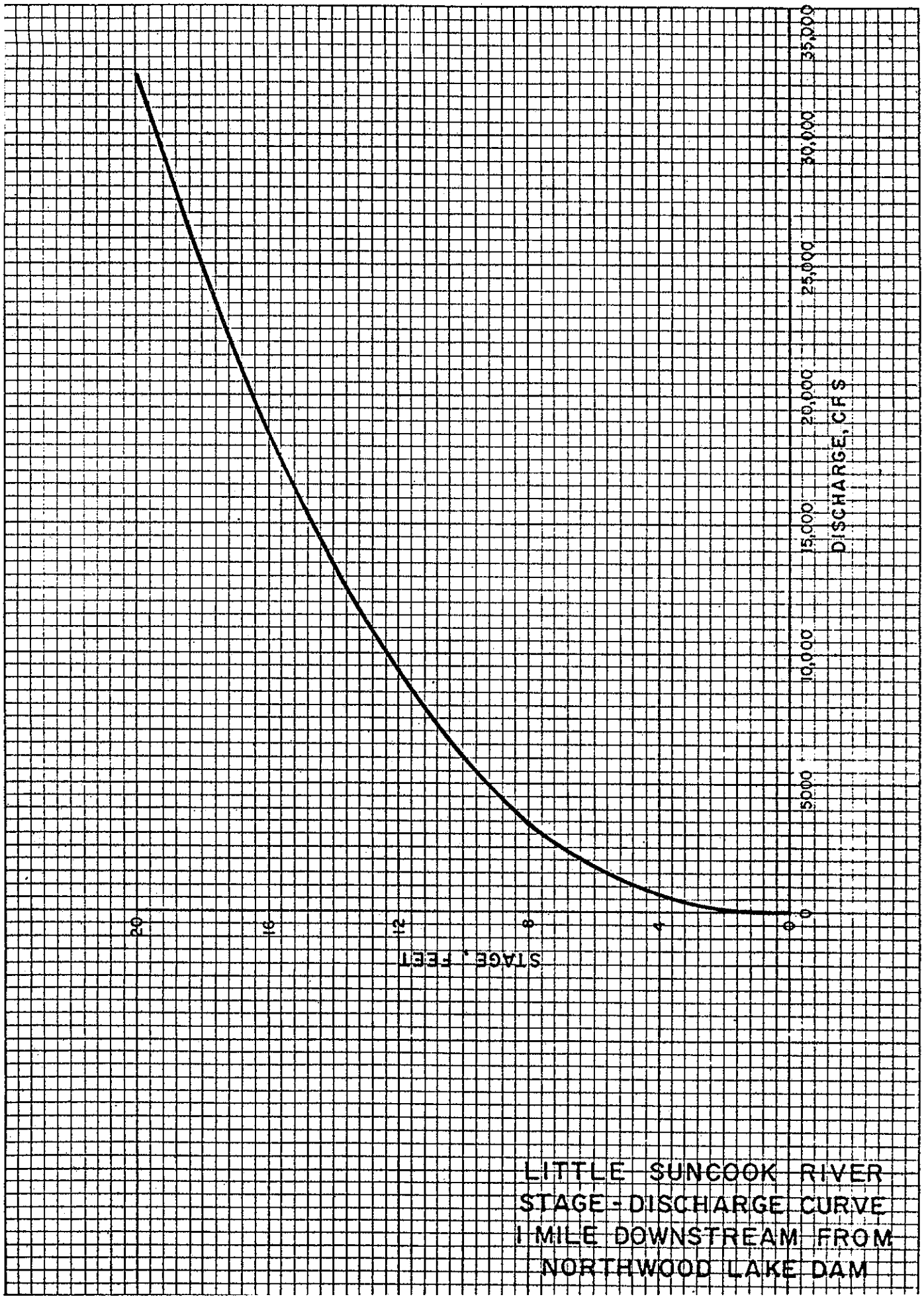
Step4: Determine stage corresponding to Q_{p_1} at each section (assumptions are same as for Stinson Lake Dam).

Peak Discharge Q_{p_1} = 9250 cfs

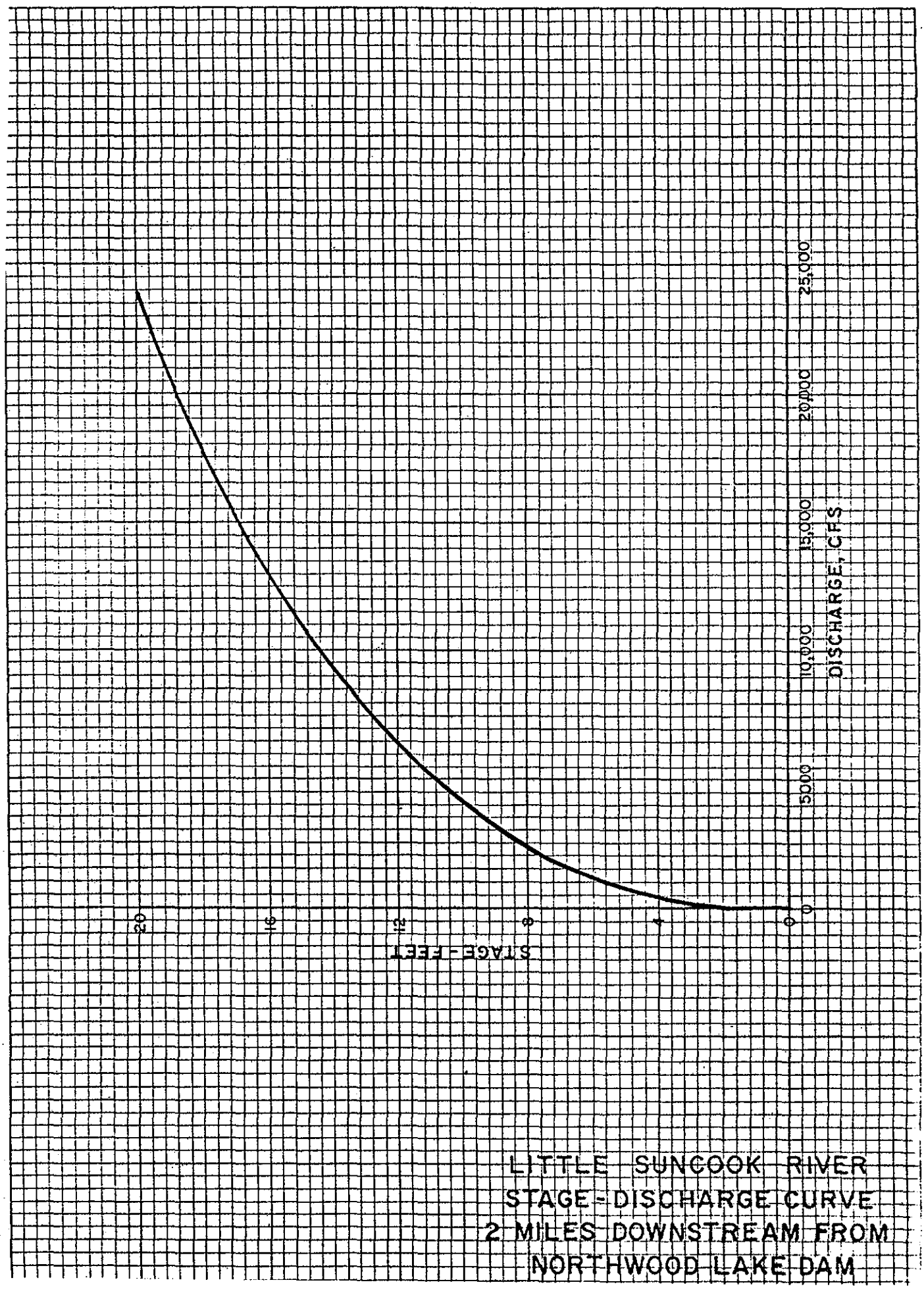
Distance downstream from Dam, miles	0	1	2	3
Stage, Feet	9.2	12.0	14.0	8.5



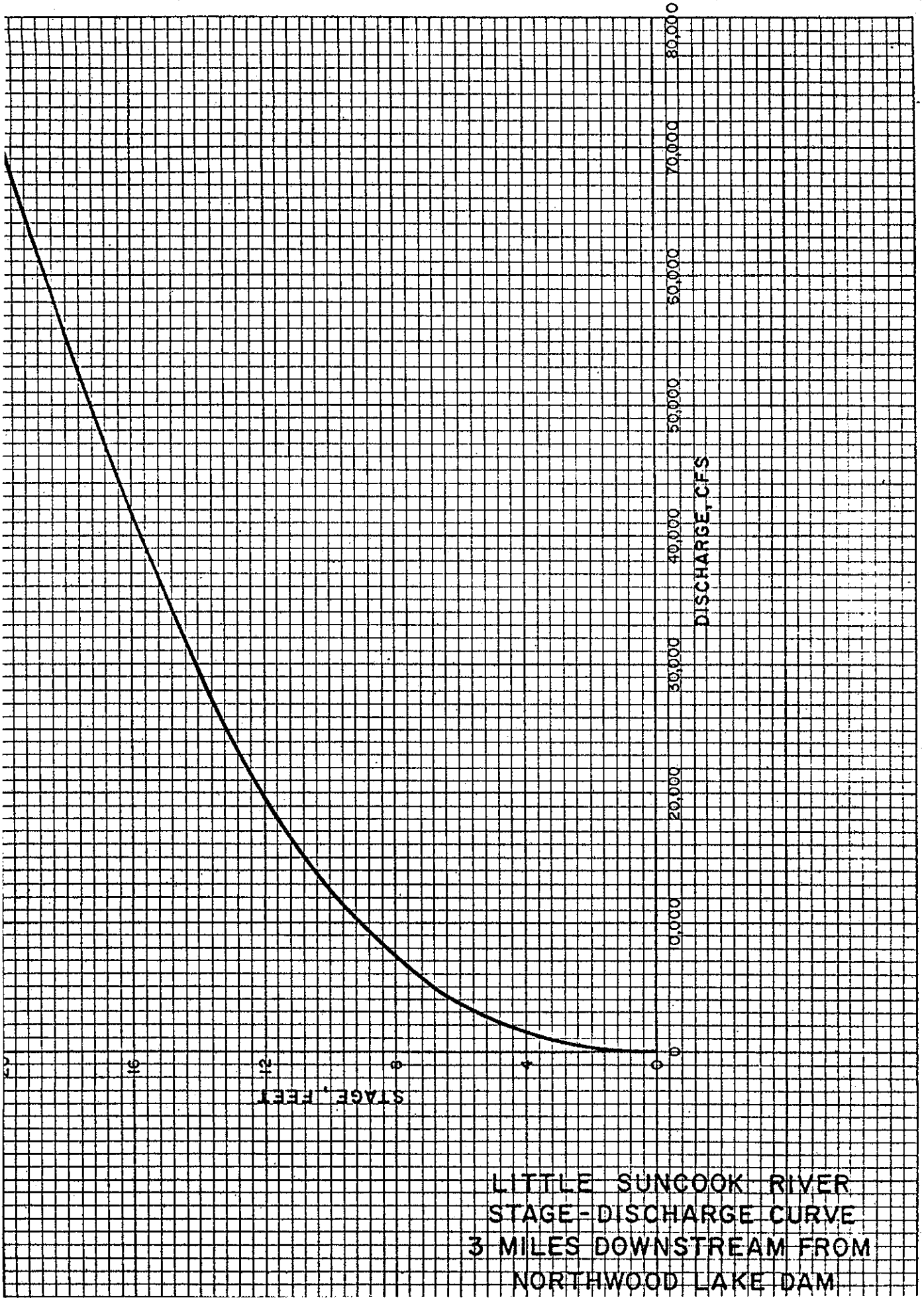
LITTLE SUNCOOK RIVER
STAGE-DISCHARGE CURVE
JUST DOWNSTREAM FROM
NORTHWOOD LAKE DAM



LITTLE SUNCOOK RIVER
STAGE - DISCHARGE CURVE
1 MILE DOWNSTREAM FROM
NORTHWOOD LAKE DAM



LITTLE SUNCOOK RIVER
STAGE-DISCHARGE CURVE
2 MILES DOWNSTREAM FROM
NORTHWOOD LAKE DAM



LITTLE SUNCOOK RIVER
STAGE-DISCHARGE CURVE
3 MILES DOWNSTREAM FROM
NORTHWOOD LAKE DAM

ENGINEERING CONSULTANTS, INC.

HAMPSHIRE DAM SAFETY INSPECTION SHEET NO. ____ OF ____

NORTHWOOD LAKE DAM JOB NO. 1211-001

3E - DISCHARGE RELATIONS AT DAM SITE BY MAS DATE 7/13/78

Assume 'n' = 0.10

Slope, $S = \frac{500 - 440}{5280} = 0.0114$ ft/ft

Discharge: $Q = \frac{1.49}{n} AR^{2/3} S^{1/2} = \frac{1.49}{.1} AR^{2/3} (.0114)^{1/2}$

$= 1.59\, AR^{2/3}$

Stage Ft.	Area A Sq. ft	Wetted Perimeter P ft	Hydraulic Radius R ft	$AR^{2/3}$	$Q = 1.59\, AR^{2/3}$ cfs
0	0	0	0	0	0
4	368	184'	2	586	932
8	1472	368'	4	3726	5924
12	3312	552'	6	11002	17493
16	5888	736'	8	23716	37708
20	9200	920'	10	43032	68421

ENGINEERING CONSULTANTS, INC.

Hampshire Dam Safety Inspection SHEET NO. ____ OF ____

Linwood Lake Dam JOB NO. 1211-001

ING CURVE OF DOWNSTREAM CHANNEL BY M.R.H. DATE 6/28/78

Stage ft.	Area A Sq. ft.	Wetted Perimeter W.P. ft.	Hydraulic Radius R ft.	$AR^{2/3}$	$Q = \frac{1.49}{n} AR^{2/3} S^{1/2}$ $Q = 1.16\, AR^{2/3}$ cu. ft./sec.
0	0	0	0	0	0
4	300	150	2	476	550
8	1160	290	4	2923	3390
12	2520	420	6	8321	9650
16	4080	510	8	16321	18930
20	6000	600	10	27852	32310

Channel Slope, $S = 40/(1.25 \times 5280) = 0.00606$ ft./ft.

$n = 0.1$

Stage - discharge curve is for 1 mile downstream

ENGINEERING CONSULTANTS, INC.

Hampshire Dam Safety Inspection — SHEET NO. ____ OF ____

Hinwood Lake Dam — JOB NO. 1211-001

RATING CURVE OF DOWNSTREAM CHANNEL — BY M.R.H. DATE 6/29/78

Stage ft.	Area A Sq. Ft.	Wetted Perimeter W.P. Ft.	Hydraulic Radius R Ft.	$AR^{2/3}$	$Q = \frac{1.49}{n} AR^{2/3} S^{1/2}$ $Q = 1.486 AR^{2/3}$ cu Ft / sec.
0	0	0	0	0	0
4	210	105	2	333	470
8	660	165	4	1663	2340
12	1380	230	6	4557	6410
16	2320	290	8	9281	13050
20	3650	365	10	16943	23820

Channel Slope, $S = 40 / (.85 \times 5280) = 0.00891$ Ft/Ft

$n = 0.10$

Stage - Discharge Curve is for 2 miles Downstream

ENGINEERING CONSULTANTS, INC.

Hampshire Dam Safety Inspection SHEET NO. ____ OF ____

Northwood Lake Dam JOB NO. 1211-001

RATING CURVE OF DOWNSTREAM CHANNEL BY M.E.H. DATE 6/29/78

Stage ft.	Area A sq. ft.	Wetted Perimeter w.p. ft.	Hydraulic Radius R ft.	$AR^{2/3}$	$Q = \frac{1.49}{n} AR^{2/3} S^{1/2}$ $Q = 1.55\, AR^{2/3}$ cu ft/sec.
0	0	0	0	0	0
4	500	250	2	794	1230
8	1820	455	4	4586	7110
12	3900	650	6	12878	19960
16	6600	825	8	26400	40920
20	9800	980	10	45490	70510

Channel Slope, $S = 40 / (0.7 \times 5280) = 0.0108$

$n = 0.1$

Stage - Discharge curve is for 3 miles downstream.

HEC 1 – COMPUTATIONS

****
HEC-1 VERSION DATED JAN 1973

****

DAM SAFETY INSPECTION - NEW HAMPSHIRE
NORTHWOOD LAKE DAM
PMP FLOOD

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
150	1	0	0	0	0	0	0	0	0

JOPER	NWT
3	0

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INPUT DERIVED TRAINGULAR SHAPED HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
1	0	0	0	0	0	1

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
-1	0	20.70	0.00	20.70	0.00	0.000	0	0	0

INPUT HYDROGRAPH

0.	802.	1603.	2405.	3207.	4008.	4810.	5611.	6413.	7215.
8016.	8818.	9620.	10421.	11223.	12024.	12826.	12292.	11757.	11223.
10688.	10154.	9619.	9085.	8551.	8016.	7482.	6947.	6413.	5879.
5344.	4810.	4275.	3741.	3206.	2672.	2138.	1603.	1069.	534.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	12826.	11890.	8984.	3562.	256520.
INCHES		5.34	16.15	19.21	19.21
AC-FT		5899.	17830.	21210.	21210.

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTH HYDROGRAPH THRU NORTHWOOD LAKE DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
1	1	0	0	2	0	1

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.000	0.00	1	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
0	0	0	0.000	0.000	0.000	-1.

STORAGE=	0.	2400.	3400.	4800.	5900.	7100.	9500.	11800.	13200.	0.
OUTFLOW=	0.	0.	800.	2700.	5800.	9400.	18700.	29500.	42000.	0.

TIME	EOP STOR	AVG IN	EOP OUT
1	2400.	0.	0.
2	2452.	401.	25.
3	2526.	1202.	100.
4	2678.	2004.	222.
5	2885.	2806.	388.
6	3142.	3607.	594.
7	3446.	4409.	863.
8	3786.	5210.	1325.
9	4153.	6012.	1822.
10	4544.	6814.	2353.
11	4947.	7615.	3116.
12	5340.	8417.	4222.
13	5709.	9219.	5264.
14	6060.	10020.	6282.
15	6394.	10822.	7284.
16	6713.	11623.	8241.
17	7021.	12425.	9164.
18	7265.	12559.	10042.
19	7406.	12024.	10589.
20	7471.	11490.	10837.
21	7479.	10955.	10870.
22	7447.	10421.	10746.
23	7386.	9886.	10508.
24	7303.	9352.	10189.
25	7206.	8818.	9810.
26	7097.	8283.	9391.
27	6976.	7749.	9029.
28	6842.	7214.	8628.
29	6699.	6680.	8198.
30	6548.	6146.	7746.
31	6391.	5611.	7275.
32	6230.	5077.	6790.
33	6064.	4542.	6294.
34	5896.	4008.	5790.
35	5725.	3473.	5307.
36	5549.	2939.	4813.
37	5371.	2405.	4310.
38	5190.	1870.	3801.
39	5008.	1336.	3287.
40	4824.	801.	2768.
41	4630.	267.	2469.
42	4436.	0.	2207.
43	4264.	0.	1972.
44	4109.	0.	1763.
45	3971.	0.	1575.
46	3848.	0.	1408.

47	3738.	0.	1258.
48	3639.	0.	1125.
49	3551.	0.	1005.
50	3472.	0.	898.
51	3402.	0.	803.
52	3338.	0.	750.
53	3278.	0.	702.
54	3222.	0.	657.
55	3169.	0.	615.
56	3120.	0.	576.
57	3074.	0.	539.
58	3030.	0.	504.
59	2990.	0.	472.
60	2952.	0.	442.
61	2917.	0.	413.
62	2884.	0.	387.
63	2853.	0.	362.
64	2824.	0.	339.
65	2797.	0.	317.
66	2771.	0.	297.
67	2747.	0.	278.
68	2725.	0.	260.
69	2704.	0.	243.
70	2685.	0.	228.
71	2667.	0.	213.
72	2649.	0.	199.
73	2633.	0.	187.
74	2618.	0.	175.
75	2604.	0.	163.
76	2591.	0.	153.
77	2579.	0.	143.
78	2568.	0.	134.
79	2557.	0.	125.
80	2547.	0.	117.
81	2537.	0.	110.
82	2529.	0.	103.
83	2520.	0.	96.
84	2513.	0.	90.
85	2505.	0.	84.
86	2499.	0.	79.
87	2492.	0.	74.
88	2486.	0.	69.
89	2481.	0.	64.
90	2476.	0.	60.
91	2471.	0.	56.
92	2466.	0.	53.
93	2462.	0.	49.
94	2458.	0.	46.
95	2454.	0.	43.
96	2451.	0.	40.
97	2447.	0.	38.
98	2444.	0.	35.
99	2441.	0.	33.
100	2439.	0.	31.
101	2436.	0.	29.
102	2434.	0.	27.
103	2432.	0.	25.
104	2430.	0.	24.
105	2428.	0.	22.
106	2426.	0.	21.
107	2424.	0.	19.

108	2423.	0.	18.	
109	2421.	0.	17.	
110	2420.	0.	16.	
111	2418.	0.	15.	
112	2417.	0.	14.	
113	2416.	0.	13.	
114	2415.	0.	12.	
115	2414.	0.	11.	
116	2413.	0.	10.	
117	2412.	0.	10.	
118	2411.	0.	9.	
119	2411.	0.	8.	
120	2410.	0.	8.	
121	2409.	0.	7.	
122	2409.	0.	7.	
123	2408.	0.	6.	
124	2408.	0.	6.	
125	2407.	0.	6.	
126	2407.	0.	5.	
127	2406.	0.	5.	
128	2406.	0.	4.	
129	2405.	0.	4.	
130	2405.	0.	4.	
131	2405.	0.	4.	
132	2404.	0.	3.	
133	2404.	0.	3.	
134	2404.	0.	3.	
135	2403.	0.	3.	
136	2403.	0.	2.	
137	2403.	0.	2.	
138	2403.	0.	2.	
139	2402.	0.	2.	
140	2402.	0.	2.	
141	2402.	0.	2.	
142	2402.	0.	1.	
143	2402.	0.	1.	
144	2402.	0.	1.	
145	2401.	0.	1.	
146	2401.	0.	1.	
147	2401.	0.	1.	
148	2401.	0.	1.	
149	2401.	0.	1.	
150	2401.	0.	1.	
SUM			256500.	

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	10870.	10623.	8295.	3527.	256500.
INCHES		4.77	14.91	19.02	19.21
AC-FT		5270.	16462.	21002.	21209.

RUNOFF SUMMARY, AVERAGE FLOW

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	1	12826.	11890.	8984.	3562.	20.70
ROUTED TO	1	10870.	10623.	8295.	3527.	20.70

1901 SOUTH NAVAJO DENVER, COLORADO 80223

****
HEC-1 VERSION DATED JAN 1973

****

DAM SAFETY INSPECTION - NEW HAMPSHIRE
NORTHWOOD LAKE DAM
ONE HALF PMP FLOOD

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
150	1	0	0	0	0	0	0	0	0

JOPER	NWT
3	0

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SUB-AREA RUNOFF COMPUTATION

INPUT DERIVED TRAINGULAR SHAPED HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
1	0	0	0	0	0	1

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
-1	0	20.70	0.00	20.70	0.00	0.500	0	0	0

INPUT HYDROGRAPH

0.	802.	1603.	2405.	3207.	4008.	4810.	5611.	6413.	7215.
8016.	8818.	9620.	10421.	11223.	12024.	12826.	12292.	11757.	11223.
10688.	10154.	9619.	9085.	8551.	8016.	7482.	6947.	6413.	5879.
5344.	4810.	4275.	3741.	3206.	2672.	2138.	1603.	1069.	534.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	12826.	11890.	8984.	3562.	256520.
INCHES		5.34	16.15	19.21	19.21
AC-FT		5899.	17830.	21210.	21210.

RUNOFF MULTIPLIED BY 0.50

0.	401.	801.	1202.	1603.	2004.	2405.	2805.	3206.	3607.
4008.	4409.	4810.	5210.	5611.	6012.	6413.	6146.	5878.	5611.
5344.	5077.	4809.	4542.	4275.	4008.	3741.	3473.	3206.	2939.
2672.	2405.	2137.	1870.	1603.	1336.	1069.	801.	534.	267.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6413.	5945.	4492.	1781.	128260.
INCHES		2.67	8.07	9.60	9.60
AC-FT		2949.	8915.	10605.	10605.

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HYDROGRAPH ROUTING

ROUTH HYDROGRAPH THRU NORTHWOOD LAKE DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
1	1	0	0	2	0	1

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.000	0.00	1	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
0	0	0	0.000	0.000	0.000	-1.

STORAGE=	0.	2400.	3400.	4800.	5900.	7100.	9500.	11800.	13200.	0.
OUTFLOW=	0.	0.	800.	2700.	5800.	9400.	18700.	29500.	42000.	0.

TIME	EOP STOR	AVG IN	EOP OUT
1	2400.	0.	0.
2	2416.	200.	12.
3	2463.	601.	50.
4	2539.	1002.	111.
5	2642.	1403.	194.
6	2771.	1803.	297.
7	2923.	2204.	419.
8	3098.	2605.	559.
9	3294.	3006.	715.
10	3507.	3407.	945.
11	3731.	3807.	1249.
12	3962.	4208.	1564.
13	4201.	4609.	1887.
14	4445.	5010.	2219.
15	4695.	5411.	2558.
16	4941.	5811.	3100.
17	5172.	6212.	3749.
18	5359.	6279.	4277.
19	5488.	6012.	4639.
20	5569.	5745.	4869.
21	5614.	5477.	4996.
22	5630.	5210.	5041.
23	5623.	4943.	5020.
24	5597.	4676.	4948.

25	5558.	4409.	4836.
26	5506.	4141.	4691.
27	5446.	3874.	4520.
28	5378.	3607.	4330.
29	5305.	3340.	4123.
30	5227.	3073.	3904.
31	5146.	2805.	3675.
32	5061.	2538.	3438.
33	4975.	2271.	3194.
34	4887.	2004.	2946.
35	4797.	1736.	2696.
36	4701.	1469.	2566.
37	4594.	1202.	2421.
38	4478.	935.	2263.
39	4353.	668.	2094.
40	4221.	400.	1914.
41	4081.	133.	1725.
42	3946.	0.	1542.
43	3826.	0.	1378.
44	3718.	0.	1231.
45	3621.	0.	1101.
46	3535.	0.	984.
47	3458.	0.	879.
48	3389.	0.	791.
49	3326.	0.	741.
50	3266.	0.	693.
51	3211.	0.	649.
52	3159.	0.	607.
53	3110.	0.	568.
54	3065.	0.	532.
55	3022.	0.	498.
56	2983.	0.	466.
57	2945.	0.	436.
58	2910.	0.	408.
59	2878.	0.	382.
60	2847.	0.	357.
61	2818.	0.	335.
62	2792.	0.	313.
63	2766.	0.	293.
64	2743.	0.	274.
65	2721.	0.	257.
66	2700.	0.	240.
67	2681.	0.	225.
68	2663.	0.	210.
69	2646.	0.	197.
70	2630.	0.	184.
71	2616.	0.	172.
72	2602.	0.	161.
73	2589.	0.	151.
74	2577.	0.	141.
75	2565.	0.	132.
76	2555.	0.	124.
77	2545.	0.	116.
78	2536.	0.	108.
79	2527.	0.	101.
80	2519.	0.	95.
81	2511.	0.	89.
82	2504.	0.	83.
83	2497.	0.	78.
84	2491.	0.	73.
85	2485.	0.	68.

86	2480.	0.	64.
87	2475.	0.	60.
88	2470.	0.	56.
89	2465.	0.	52.
90	2461.	0.	49.
91	2457.	0.	46.
92	2453.	0.	43.
93	2450.	0.	40.
94	2447.	0.	37.
95	2444.	0.	35.
96	2441.	0.	33.
97	2438.	0.	30.
98	2436.	0.	28.
99	2433.	0.	27.
100	2431.	0.	25.
101	2429.	0.	23.
102	2427.	0.	22.
103	2426.	0.	20.
104	2424.	0.	19.
105	2422.	0.	18.
106	2421.	0.	17.
107	2419.	0.	15.
108	2418.	0.	14.
109	2417.	0.	14.
110	2416.	0.	13.
111	2415.	0.	12.
112	2414.	0.	11.
113	2413.	0.	10.
114	2412.	0.	10.
115	2411.	0.	9.
116	2411.	0.	8.
117	2410.	0.	8.
118	2409.	0.	7.
119	2409.	0.	7.
120	2408.	0.	6.
121	2407.	0.	6.
122	2407.	0.	5.
123	2406.	0.	5.
124	2406.	0.	5.
125	2406.	0.	4.
126	2405.	0.	4.
127	2405.	0.	4.
128	2404.	0.	3.
129	2404.	0.	3.
130	2404.	0.	3.
131	2404.	0.	3.
132	2403.	0.	3.
133	2403.	0.	2.
134	2403.	0.	2.
135	2403.	0.	2.
136	2402.	0.	2.
137	2402.	0.	2.
138	2402.	0.	2.
139	2402.	0.	1.
140	2402.	0.	1.
141	2402.	0.	1.
142	2401.	0.	1.
143	2401.	0.	1.
144	2401.	0.	1.
145	2401.	0.	1.
146	2401.	0.	1.

147	2401.	0.	1.
148	2401.	0.	1.
149	2401.	0.	0.
150	2401.	0.	0.
SUM			128245.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	5041.	4952.	3867.	1753.	128245.
INCHES		2.22	6.95	9.45	9.60
AC-FT		2456.	7674.	10440.	10604.

RUNOFF SUMMARY, AVERAGE FLOW

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	1	6413.	5945.	4492.	1781.	20.70
ROUTED TO	1	5041.	4952.	3867.	1753.	20.70

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

(1) STATE	(2) IDENTITY NUMBER	(3) DIVISION	(4) STATE	(5) COUNTY	(6) CONGR DIST.	(7) STATE	(8) COUNTY	(9) CONGR DIST.	NAME	(10) LATITUDE (NORTH)	(11) LONGITUDE (WEST)	(12) REPORT DATE DAY | MO | YR
NH	285	NED	NH	013	01				NORTHWOOD LAKE DAM	4313.2	7117.5	150CT78

(13) POPULAR NAME	(14) NAME OF IMPOUNDMENT
	NORTHWOOD LAKE

(15) REGION	(16) BASIN	(17) RIVER OR STREAM	(18) NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	(19) DIST FROM DAM (MI.)	(20) POPULATION
01	05	LITTLE SUNCOOK RIVER	EPSOM	2	200

(21) TYPE OF DAM	(22) YEAR COMPLETED	(23) PURPOSES	(24) STRUCTURAL HEIGHT (FT.)	(25) HYDRAULIC HEIGHT (FT.)	(26) IMPOUNDING CAPACITIES MAXIMUM (ACRE–FT.)	(27) IMPOUNDING CAPACITIES NORMAL (ACRE–FT.)
CTPG	1926	RC	13	13	3000	2400

DIST OWN FED R PRV/FED SCS A VER/DATE

(28) REMARKS

(29) D/S HAS	(30) SPILLWAY CREST LENGTH	(31) SPILLWAY TYPE	(32) SPILLWAY WIDTH (FT.)	(33) MAXIMUM DISCHARGE (FT.)	(34) VOLUME OF DAM (CY)	(35) POWER CAPACITY INSTALLED (MW)	(36) POWER CAPACITY PROPOSED (MW)	(37) NAVIGATION LOCKS NO.	(38) LENGTH (FT.)	(39) WIDTH (FT.)	(40) LENGTH (FT.)	(41) WIDTH (FT.)	(42) LENGTH (FT.)	(43) WIDTH (FT.)	(44) LENGTH (FT.)	(45) WIDTH (FT.)
1	165	C	109	350												

(46) OWNER	(47) ENGINEERING BY	(48) CONSTRUCTION BY
NH WATER RES BD		

(49) REGULATORY AGENCY DESIGN	(50) CONSTRUCTION	(51) OPERATION	(52) MAINTENANCE
NONE	NONE	NONE	NONE

(53) INSPECTION BY	(54) INSPECTION DATE DAY | MO | YR	(55) AUTHORITY FOR INSPECTION
HARRIS-ECI ASSOCIATES	05JUN78	PL 92-367

(56) REMARKS